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A RAND NOTE

THE RAND STRATEGY ASSESSMENT SYSTEM'S GREEN
AGENT MODEL OF THIRD-COUNTRY BEHAVIOR IN
SUPERPOWER CRISES AND CONFLICT

David A. Shlapak, William L. Schwabe,
Mark A. Lorell, and Yoav Ben-Horin

September 1986

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The Director of Net Assessment,
Office of the Secretary of Defense



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PREFACE

Green Agent, formerly called Scenario Agent, is the Rand Strategy Assessment System's (RSAS's) rule-based computer model of third-country political-military behavior in conflicts involving one or both superpowers. This Note describes the third-generation version, and supersedes all previous Scenario Agent documentation.¹ The Note provides information needed to set up and run the Green Agent in RSAS war games. It should be of interest both to political-military analysts and to modelers.

This Note is a revision of N-2363-NA, *The Mark III Scenario Agent: A Rule-Based Model of Third-Country Behavior in Superpower Crises and Conflict*, published in October 1985. The revision corrects editorial problems, provides improved figures, utilizes up-to-date Rand Strategy Assessment System terminology, and includes updated decision rules valid as of July 1986. A major reworking of Green Agent will be completed and reported upon early in 1987.

The work for this project was conducted under the auspices of Rand's National Defense Research Institute, a Federally Funded Research and Development Center sponsored by the Office of the Secretary of Defense. Comments and inquiries are welcome; they should be addressed to the authors or to Dr. Paul K. Davis, Director of the Rand Strategy Assessment Center.

¹J. A. Dewar, W. Schwabe, and T. L. McNaugher, *Scenario Agent: A Rule-Based Model of Political Behavior for Use in Strategic Analysis*, The Rand Corporation, N-1781-DNA, January 1982, and W. Schwabe and L. M. Jamison, *A Rule-Based Policy-Level Model of Nonsuperpower Behavior in Strategic Conflicts*, The Rand Corporation, R-2962-DNA, December 1982.

SUMMARY

The Rand Strategy Assessment Center (RSAC) is developing the Rand Strategy Assessment System (RSAS), an automated war-gaming facility, designed for use by various defense agencies. Green Agent's function is to represent nonsuperpower (third-country) responses to superpower crises and conflicts. The national actors modeled by Green Agent

- Acquire data from the rest of the RSAS that are used in defining their situation,
- Evaluate the data according to rules defining their assumed national decisionmaking styles, and
- Produce responses which are the model's output to the RSAS.

Green Agent represents an evolutionary development of the second-generation Scenario Agent. While the newer model retains the perception-response dynamic as the heart of its design, it contains significant changes in two principal areas:

1. The *substantive content* of the model's rule-base has been enhanced to improve Green Agent's power, flexibility, and robustness.
2. Green Agent was *reprogrammed* in Rand-Abel®, a C-based high-level computer language developed by the RSAC, to make the model execute more efficiently. Rand-Abel is an English-like language currently used for programming RSAS Red, Blue, and Green Agents.

An actor modeled by Green Agent assesses its situation by examining data available to it from the rest of the RSAS. The decisionmaking logic integrates this diverse information into a world view with three elements:

1. The extent to which the actor perceives itself *threatened* by its political-military environment.

2. The resources it perceives as available to deal with this danger; that is, how *effectively* it can cope with the threat.
3. Any superpower *requests* for the actor's *cooperation* or *involvement*.

Each nonsuperpower is modeled parametrically by Green Agent; factors of interest include generalized measures of sociopolitical orientation, alliance relations, military strength (including nuclear capability), and national decisionmaking character and resolve. These parameters are fully under the control of the RSAS user who can thereby structure the global context of a superpower conflict to reproduce a broad range of third-country behaviors.

The world situation perceived by the actor is processed by decision rules shaped and controlled by these parameters to produce a set of responses which represent the output of Green Agent to the RSAS at large. Each actor's behavior is characterized along three dimensions:

1. The extent to which it *cooperates* with its superpower ally, if any, in granting that ally use of its airspace, territory and facilities,
2. The extent to which the actor *involves* its own armed forces in an ongoing superpower conflict, and
3. The extent to which the actor *independently uses its military assets*, specifically any *nationally-owned nuclear weapons*, in a superpower conflict.

The Note is organized with diverse reader interests in mind. Section I is an Introduction that includes a brief overview of the RSAS automated war-gaming system. Section II describes the third-country political-military behavior modeled by Green Agent. Section III gives a technical description of the model; it includes a brief introduction to the Rand-Abel computer language.

ACKNOWLEDGMENTS

The current Green Agent model has evolved from two earlier versions, which were called Scenario Agent. The Mark I model was the brainchild of William Jones; the implementation was done by James Dewar, Thomas McNaugher, and William Schwabe. Carl Builder directed the overall Mark I RSAC development work. The Mark II version was developed by William Schwabe and Lewis Jamison. Paul K. Davis directed the overall Mark II and III RSAS development; his active involvement prompted many of the improvements visible in the Mark II Scenario Agent and the current Green Agent.

Development of the current Green Agent made demands on other RSAS language and model developers. We would especially like to acknowledge the contributions of Arthur Bullock, H. Edward Hall, and Herbert Shukiar.

This Note was thoughtfully reviewed by Rand colleagues Peter deLeon, Edmund Dews, and David Kassing. It was edited by Patricia Bedrosian.

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I. INTRODUCTION

OVERVIEW

Green Agent is one of several computer models used in the Rand Strategy Assessment System (RSAS) to support automated war gaming. The RSAS, including Green Agent, will be transferred to the government to use in gaming a broad range of superpower conflict scenarios.

To judge the credibility of gaming results, one needs to understand the models, including Green Agent. The depth of understanding necessary will vary from person to person. For some people, a general overview of the RSAS will be sufficient; a brief overview is incorporated in this Introduction.¹

This Note is a technical description of the Green Agent model. Section II outlines the range of political-military behavior the Green Agent is intended to simulate. Section III addresses the architecture of the model and should be of interest to RSAS users and computer modelers wishing to enrich or otherwise change Green Agent rules.

The Green Agent architecture is fixed for the near future, but individual rules are inserted or improved continually. Appendix A provides the rules as they existed in July 1986. Discrepancies exist between the model as documented and the code in Appendix A, since all elements of the current RSAS are not capable of supporting some aspects of Green Agent design.

Appendix B is a selected bibliography of RSAC publications.

It is perhaps important to note what this document is *not*. It does not describe applications of either the Green Agent or the RSAS; nor does it present the detailed political-military analysis underlying the model's rules or the assumptions the authors would make about the

¹A more comprehensive overview of the current RSAS can be found in Paul K. Davis, Steven C. Bankes, and James P. Kahan, *A New Methodology for Modeling National Command Level Decisionmaking in War Games and Simulations*, The Rand Corporation, R-3290-NA, July 1986. See also Paul K. Davis and James A. Winnefeld, *The Rand Strategy Assessment Center: An Overview and Interim Conclusions about Utility and Development Options*, The Rand Corporation, R-2945-DNA, March 1983.

behavior of particular countries in applications studies. Rather, this Note focuses on the structural aspects of the parametric Green Agent model.

OVERVIEW OF THE RAND STRATEGY ASSESSMENT SYSTEM

Figure 1.1 shows the major components of the RSAS. The **Red** and **Blue Agents** model the decisionmaking processes of the Soviet Union and the United States, respectively. Additionally, the Red and Blue Agents represent the formal command structures of NATO and the Warsaw Pact. Red and Blue each function at several interacting levels of command, including:

1. The *National Command Level* (NCL) functions as the Blue National Command Authority or its Soviet analogue, assessing the world situation, establishing contexts and objectives for action, selecting analytic war plans (AWPs) for execution, and so forth. Alternative NCL rule sets allow a choice of decisionmaking styles, known as "Ivans" and "Sams."
2. The *Global Command Level* (GCL) functions similarly to a Red *Stavka* or Blue Joint Chiefs of Staff and State Department, coordinating the major field commands and processing international communications.

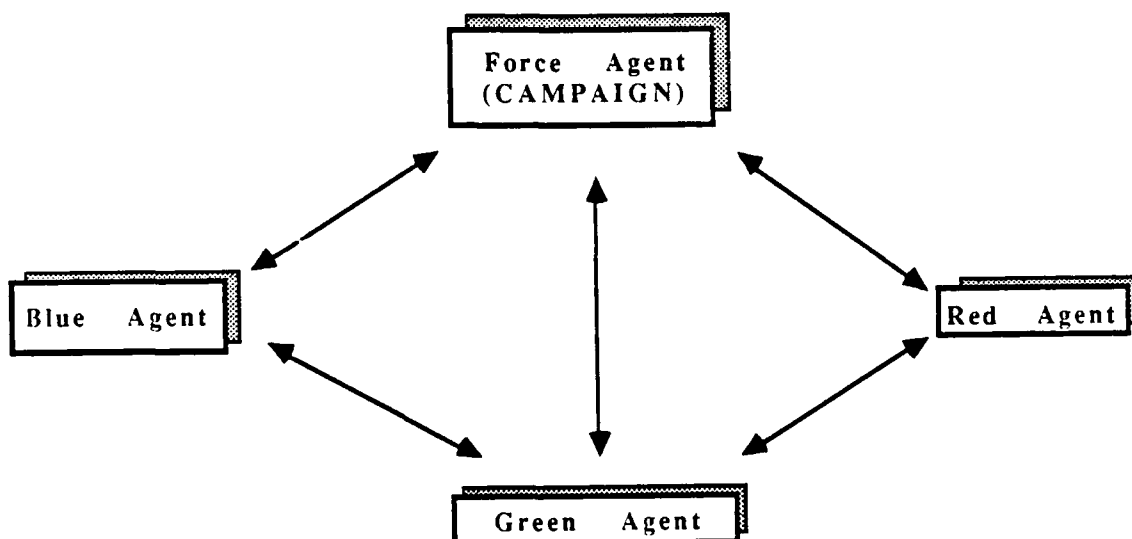


Fig. 1.1 -- RSAS Agent Interfaces

3. The *Supertheater Command Levels* (SCLs) function as regional coordinating commands, such as Blue's SACEUR (Supreme Allied Commander Europe), coordinating their subordinate theater commanders.
4. The *Area Command Levels* (ACLs) function as theater commanders, such as Blue's CINCSAC (Commander in Chief Strategic Air Command) or Soviet theater commanders, issuing orders to their forces.

The **Force Agent** is an integrated group of combat models simulating a broad range of conflict from low-level conventional combat to battlefield, theater, and strategic nuclear warfare.

Green Agent, the subject of this Note, models the behavior of nonsuperpower countries within the RSAS's context of superpower conflict. Green Agent consists of a collection of rule sets which determine the actions of these third countries according to the world situation and superpower requests. Green Agent countries are also able to carry out a limited range of independent military activity.

II. POLITICAL-MILITARY BEHAVIOR MODELED BY GREEN AGENT¹

Green Agent models the various third parties that may be involved in conflicts between the superpowers.²

Green Agent characterizes third-country behavior in terms of "perception" that prompts "response." Perception is mainly in terms of "perceived threat" to the third country in the current game situation, "perceived effectiveness" of the third-country "actor" in responding to the situation, and requests or demands being made on the actor by the superpowers. Response is in terms of the "side" a third-country takes in the conflict, "cooperation" of the actor with a superpower, and "involvement" of the actor's own forces in the conflict.

An actor's perception of the current situation is determined by Green Agent rules. If an RSAS user wants to change how Green Agent models a third country's perception, the user must change Green Agent's rules. The rules are modular, so many kinds of changes are easy to make.

An actor's response, given its perception of the current situation, is determined by which alternative "response pattern," also consisting of rules, the system user has selected for a particular game run. Thus, if a system user wants to change how Green Agent models a third country's response, the user usually needs only to change some parameter settings. If none of the available response patterns are satisfactory, then the user must change response rules, but this should not generally be the case.

The perception-response structure is represented graphically in Fig. 2.1.

In the following sections we will examine first the rules and categories governing the perceptions of third countries modeled by the

¹Unless otherwise specified, "Green Agent" refers to the current version of the model.

²In other RSAC publications, we have referred to these countries as "nonsuperpowers" and "scenario countries."

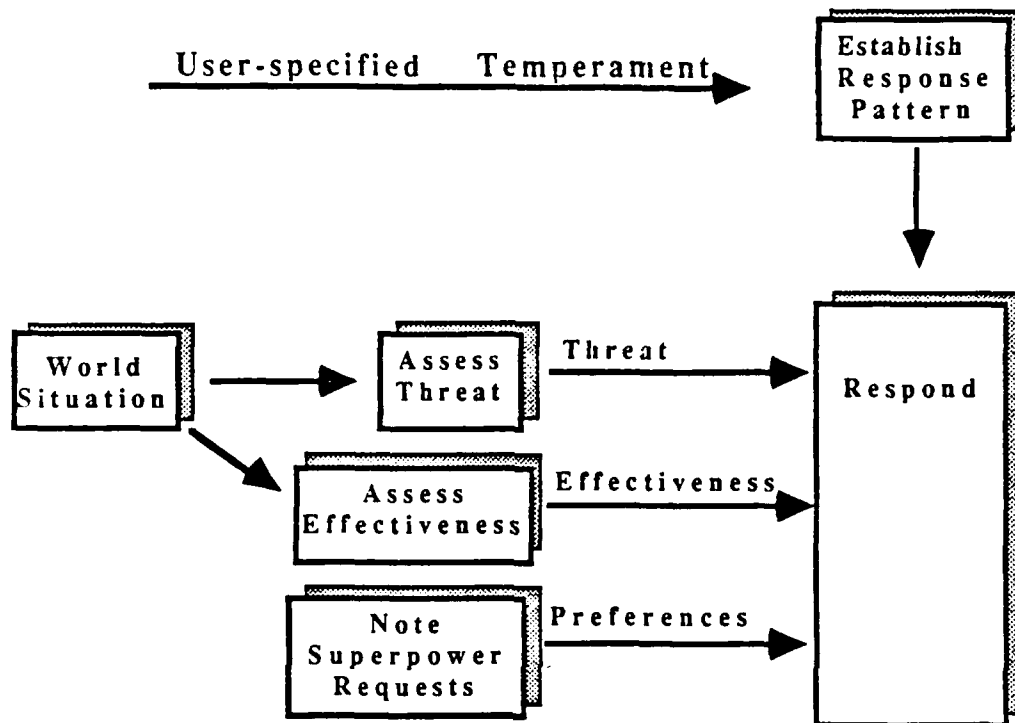


Fig. 2.1 -- Green Agent Perception-Response Structure

Green Agent. We will then discuss the structure of the responses available to these actors that represent the output of the Green Agent to the rest of the RSAS. Finally, we will describe the various decisionmaking patterns that are used to map perceptions onto appropriate responses.

PERCEPTION VARIABLES

The first requirement placed upon a nonsuperpower in Green Agent is to develop and organize its view of the global situation. This is satisfied through assessments of two principal conditions, which we have called threat and effectiveness.

In Green Agent's threat-assessment routine, the actor isolates those elements in the world situation which present it with the prospect of short- or long-term harm to its interests.

Threat Assessment

Green Agent categorizes threats into seven gradations, each of which represents a more severe or immediate danger than the one immediately below it. These categories are presented in Table 2.1.

A country conducts threat assessment using rules which manipulate and interrelate military, geographical, and political information. The variables used and their significance are shown in Table 2.2.

The threat-assessment rules are organized hierarchically from lowest to highest threat category. This is done so that regardless of the number of different threats an actor perceives he will base his actions upon the most dire.

To cite an example using the categories and definitions from Table 2.2: Egypt, a Blue-oriented actor, is determining its threat. It looks at the current situation and discovers that a new contingent of Soviet troops has arrived in Libya. This would represent a serious threat to Egypt, since it is a fresh presence of forces belonging to an opposing superpower.

At the same time Egypt notes that a conventional conflict between Red and Blue is ongoing in Europe; that is, out of Egypt's region. This, according to the threat scale, confronts Egypt with an indirectly-grave threat. These being the only two threats Egypt perceives, it would act on the basis of the indirectly-grave threat.

The rules governing threat assessment cover a broad spectrum of possible contingencies. Insofar as possible, they are general rules, applicable to the greatest number of actors or triggered by the widest range of circumstances. However, there are some that are quite particular which apply to specific countries and events. For example, there are special rules governing a Soviet invasion of a Warsaw Pact member or of Yugoslavia. There are rules specifying Egypt's perception of threat regarding large Soviet forces in neighboring Libya and Syria's agitation at Blue troops in Israel. The purpose, in brief, is to

Table 2.1
THREAT CATEGORIES

| Category of Threat | Definition |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mortal | National existence is in immediate jeopardy, e.g., large-scale nuclear attack or large-scale deep invasion. |
| Indirectly-Mortal | Long-term prospects for survival are threatened, e.g., involvement in a conflict where nuclear weapons are in use other than in one's homeland. |
| Grave | Direct and immediate threats to national interests not involving combat in one's territory; however, they may portend it. E.g., enemy mobilization on one's border or combat between one's superpower ally and the opposing superpower within one's geographic region. |
| Indirectly-Grave | Threats similar in kind to grave, but less immediate in time or geography. E.g., combat between superpowers outside one's geographic region. |
| Serious | Troublesome events within one's region which do not portend immediate danger but do indicate a heightening of tensions or a shift in the regional balance of power. E.g., an insertion of troops belonging to an opposing superpower into another country in one's geographic region. |
| Indirectly-Serious | Troublesome events similar to serious threat but occurring outside one's geographic region. |
| Indeterminate | No perceived threat, or none sufficient to provoke a political-military response. |

Table 2.2

PRINCIPAL VARIABLES USED IN THREAT ASSESSMENT

| Variable | Value | Definition and Significance of Variable |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Blue-Presence Red-Presence | Major TripW Token None | Size of Blue- or Red-controlled forces in a country. A threat to countries not similarly oriented. |
| Orientation | Blue Red White | A country's long-term alignment with either or no superpower. Influences whether a superpower force is a threat. |
| Region | Europe SWA etc. | Geographical location on a more or less continental scale. An adverse situation is more threatening if occurring in one's own region. |
| Alliance-Membership | NATO WP | Military alliance. A threat to a member of one's alliance is a threat to oneself. |
| Conflict-Location- Status (of country) Conflict-Status (of region) | None Limited-Conv Conventional Chemical Nuclear | Indicator of level of combat within a country or region. The higher the level and the nearer the country or region, the greater the threat. |
| USSR-Border- Mobilization-Status US-Border- Mobilization-Status | Yes No | Whether Soviet or U.S. forces are mobilized on one's border. A threat if hostile. |
| European-Weapons- Type Southwest-Asian- Weapons-Type | None Conventional CBR Battlefield- Nuclear Theater- Nuclear | Level of weaponry in use in indicated theater. There are separate variables for Blue, Red, and White weapons. Higher levels of enemy weapon use constitute higher threats. |
| Intercontinental- Weapons-Type | None Nuclear | Level of weaponry in use in intercontinental (U.S.-USSR) theater. |
| Cooperation European-involvement SWAsian-involvement Nuclear-involvement | As indicated in Tables 2.5, 2.6 and 2.7. | |

combine efficiency (both in rule-writing and at run-time) with analytic versatility and power.

Automatic Response

Whether or not an actor will further endeavor to interpret the world situation is dependent upon the outcome of the threat assessment phase. We have inserted a distinction in Green Agent that splits national actions into two broad subcategories: automatic response and effectiveness assessment-based response.

While no country ever responds to the international situation "automatically," it is useful for modeling purposes to simplify processing demands by treating certain categories of behavior as though it did. When perceived threat is low (less than grave), a modeled nation will behave in a way that is primarily conditioned by its relations with its superpower ally. If it tends to be a reliable ally of the superpower it will follow that tendency by agreeing to respond more or less as the ally has requested. This is termed "automatic response."

Each response pattern, or temperament, has an automatic response limit built in. An actor with a given temperament will assent to allied requests up to this limit (assuming that the threat it perceives is less than grave). If the ally has made a request which exceeds the limit, the actor will meet him halfway by adopting the posture which is the closest possible (given the limit) to that requested.

A crucial part of the distinction among temperaments is the different automatic response limit associated with each one. Less "reliable" allies will have lower automatic response limits.

If, however, the actor perceives a grave, indirectly mortal, or mortal, threat Green Agent will put it through a second phase of information-filtering, namely effectiveness assessment.

Effectiveness Assessment

When confronted with a severe (grave or mortal) threat, the simplification represented by automatic response ceases to be adequate. It is no longer sufficient to ground decisionmaking in a country's alliance relations. A further step is needed, one which takes into account the capability of the actor and its allies (especially any allied superpower) to handle the danger it faces.

Effectiveness assessment serves this role in Green Agent. This is another package of rules which, like threat assessment, filters world situation data into a form which can serve as a basis for national decisionmaking.

In the Mark III Green Agent, effectiveness assessment is a very simplified process. Actors themselves are characterized according to their Military-Strength, a variable which, in a very simplified manner, evaluates each country's armed forces on two bases:

- Comparison to the military capabilities of regional neighbors and
- Ability to affect a Red/Blue conflict in the nation's region.

This evaluation results in the assignment of a military-strength value of strong, average, or weak to each country's forces. This is obviously a highly aggregate manner of evaluating an actor's armed strength, and it ignores many particulars of force structure and capability. However, it constitutes an effective shorthand method for dealing with a highly complex issue in a manageable way.

The rules for effectiveness assessment also reflect the overall military situation, which usually depends more upon the activities and efficacy of the superpowers than on the behavior of any particular third country. This characterization for European and Southwest Asian scenarios involves three metrics:

- the force ratio at the front,
- the deepest penetration of enemy forces into friendly territory, and
- the speed at which enemy forces are advancing.

This characterization is performed to give the actor a general picture of how well (or poorly) his side (or would-be side) is faring in the ongoing conflict. If an actor's side is doing well, an actor will be more prone to join in (or stay in) the conflict than if his side were doing poorly.³ The actor's behavior will also be affected by his perception of his own potential impact on the conflict: a stronger actor will be more likely to involve itself in a conflict than a weaker one, all other things being equal. The idea here is simply that more powerful countries (such as the United Kingdom or France) will perceive themselves as more capable of effecting a favorable shift in the threatening situation, and will therefore be more willing to take action.

There are three possible results from effectiveness assessment: High, which indicates that the actor's side would do well if the actor participates; Medium, which suggests that the outcome is unclear even with the actor's participation; and Low, which signifies that the actor's side will do poorly despite his participation.

The current method of effectiveness assessment in the Green Agent is oriented towards actors of Blue or White (neutral) orientation; that is, countries that are essentially disposed against Soviet expansion. Thus, the rules and results are all expressed from a Blue point of view.

Although this approach is debatable, and can be amended in studies requiring a different approach, it has several virtues. Our reasoning is that the Warsaw Pact-member countries do not assess effectiveness so

³This approach implies that nations in conflict utilize "bandwagoning" rather than "balancing," or "minimum-winning-coalition" strategies. Although this may not be in agreement with some theoretical formulations of international behavior (e.g., Waltz' theory of balance of power politics), it does seem to fit in with much historical evidence. Germany declaring war on the United States in 1941 and the Soviet Union joining the war against a beaten Japan in 1945 are examples of this bandwagoning phenomenon.

long as they are more or less "captives" of the Soviet Union. Only if such an actor breaks away from its Red ally will it begin to assert its independent perceptions of the world. At such a point it would be fair to say that the actor will be averse to Soviet success, since such success might well make maintaining its newfound freedom somewhat difficult.

Additionally, in most instances where defections from the Pact appear likely, the probabilities seem to be that the former Soviet allies will endeavor to make themselves as inconspicuous as possible; they will most likely be most concerned with internal stability and security and not be in a position to take up arms against their former patron. Thus, they will be largely unconcerned with their potential effect upon the ongoing war should they choose to take part: indeed, their greatest effect will already have been felt in the very act of their defection.

Finally, different images of Warsaw Pact solidarity can be implemented by altering the values of a few easily accessed parameters, particularly temperament, which specifies the decisionmaking pattern of each actor.

It is also important to note that the current set of effectiveness assessment rules is both an integral part of Green Agent and a marker for future development. We recognize that many political and military factors, such as alliance solidarity, prospects for direct aid from one's superpower ally, or domestic political considerations, might be at least as important as the ones we have identified in a national decisionmaking process. Rules covering such factors could be added to Green Agent with relative ease.

Superpower Requests

A third element in the analysis of nonsuperpower perception as modeled by Green Agent is superpower requests or "preferences." Simulating third-country responses to such requests is, in fact, the principal purpose of the Green Agent. The model is intended to provide a credible background of third-party behavior against which Red and Blue conflicts can be played. As such, simulating nonsuperpower responses to Blue or Red Agent requests is the critical function of Green Agent.

This significance is suggested, for example, by the fact that these requests are considered co-equal for purposes of prompting a Green Agent move with the invasion of a country, or the explosion of nuclear weapons on its territory.

This criticality is further confirmed in the response rules, where behavior is characterized in relation to any received superpower preferences. Nonsuperpower activity is generally presented in terms of being less than, equal to, or greater than that requested by that actor's ally.

Red and Blue Agents can issue preferences for the four major types of nonsuperpower response: side, cooperation, and European or Southwest Asian involvement. These requests are acted upon immediately by the target actors, and the results of their decisionmaking are inserted in the World Situation Data Set (WSDS) immediately.

Currently, the Green Agent does not support explicit two-way communication or bargaining between superpowers and their allies. This omission was necessitated by the Red and Blue Agent's inability to deal with incoming messages. Currently, this capability in a primitive form exists and will be further developed in the coming year. We anticipate adding the appropriate structure and rules by 1987 to enable Green Agent to exploit this mechanism.

RESPONSE VARIABLES

Definitions

The five primary response variables are shown in Table 2.3. These are the major aspects of third-country political-military posture of interest to military analysts. Green Agent establishes these responses at each game move for each third country.

In Green Agent, to establish a response is to set the value of a response variable in the RSAS data base. The response variable side can be set to any of three values, as shown in Table 2.4. Notice that "side" is the actor's side in the current conflict. Later we will discuss the user-specified parameter "Orientation," similarly taking values Blue, Red, or White, but referring to long-term orientation, rather than side in the current conflict.

Table 2.3

RESPONSE VARIABLES: THE OUTPUT FROM THIRD-COUNTRY DECISIONS

| Variable | Definition |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Side | The side, if any, the actor has committed itself to in the current conflict. |
| Cooperation | The extent to which an actor is willing to cooperate with the superpower with whom it has sided in granting requests other than for involvement of the actor's own armed forces. |
| European-involvement | The extent to which an actor is willing to involve its own armed forces in a current conflict in Europe. |
| SWAsian-involvement | The extent to which an actor is willing to involve its own armed forces in a current conflict in Southwest Asia. |
| Nuclear-involvement | The extent to which a nuclear-capable actor is using nuclear weapons independently. |

Table 2.4

SIDE: THE ACTOR'S SIDE IN THE CURRENT CONFLICT

| Value of Variable | Definition |
|-------------------|------------------------------------------------------------|
| Blue | Siding with the United States in the current conflict. |
| Red | Siding with the Soviet Union in the current conflict. |
| White | Not siding with either superpower in the current conflict. |

Table 2.5

COOPERATION: THE EXTENT OF COOPERATION WITH A SUPERPOWER

| Value of Variable | Definition |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Uncooperative | Denying and opposing superpower access to the actor's national territory and other resources. |
| Normal | Granting usual peacetime basing rights to the superpower, if any, with which the actor is normally aligned. |
| Transit-base | Granting overflight and transit rights to support the actor's side in a current conflict <i>outside</i> the actor's region. |
| Reinforcement | Granting overflight and transit rights to support the actor's side in a current conflict <i>within</i> the actor's region. |
| Cobelligerent | In addition to transit-base or reinforcement level of cooperation, granting permission for the actor's side to launch <i>conventional combat missions</i> from the actor's territory and/or against enemy forces occupying the actor's territory. |
| Nuc-releasor | In addition to cobelligerent level of cooperation, granting permission for the actor's side to launch <i>nuclear combat missions</i> from the actor's territory and/or against enemy forces occupying the actor's territory. |

The response variable cooperation can be set to any of the values shown in Table 2.5. Reading down the table, the level of cooperation increases. In most cases, lesser levels of cooperation are included in the greater levels. Cooperation has to do with permission to use third-country air space, territorial waters, and land for various military purposes. The higher the level of cooperation, the greater the freedom of action granted to the actor's superpower ally and, potentially, a greater risk of attack on the actor by its superpower enemy.

The values of European involvement are shown in Table 2.6. The NATO and Warsaw Pact alert levels differ somewhat from those of other third countries. Only nuclear-capable third countries can become nuclear-combatants. Otherwise European involvement can take on the same values for all third countries.

The values for SWAsian-involvement are shown in Table 2.7. The values are the same as for European involvement, except the purely NATO and Warsaw Pact alert statuses do not apply.

The values for independent Nuclear involvement are shown in Table 2.8.

These variables define the limits of Green Agent behavior. They cover a wide and varied range of political and military responses to evolving situations.

The values of cooperation, European involvement, and Southwest Asian involvement are arranged hierarchically; each successive level of cooperation or involvement subsumes all lesser levels.⁴ This simplifies response generation significantly.

For example, a sudden "standing start" type invasion might take the Federal Republic of Germany (FRG) by surprise, with its forces at peacetime strengths and preparedness. If each level of European involvement were independent, the FRG (as modeled by Green Agent) would need to issue several separate orders--the various alert levels one by one, followed by the order which would actually send its forces into combat. Instead, FRG only makes the change from normal to combatant. The Force Agent's models simultaneously alert, mobilize, deploy, and take into combat West German troops and assets.⁵

⁴This is true except for the minimal values of Uncooperative and Disengaged.

⁵These assets would go into combat initially at their peacetime strengths, however, since the Force models require time to increase the readiness of forces and deploy them to their combat stations. In such a situation, newly mobilized forces would be fed into combat as they became available.

Table 2.6

EUROPEAN-INVOLVEMENT: COMMITMENT OF FORCES IN EUROPE

| Value of Variable | Definition |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| For all third countries: | |
| Disengaged | Having previously committed its forces to the conflict in Europe, disengaging and withdrawing own forces from foreign locations of conflict. |
| Normal | Not involving the actor's forces in the conflict in Europe unless attacked. |
| For NATO members: | |
| Simple-alert | Alerting own forces for conflict in Europe, corresponding to the official NATO alert statuses of the same names. |
| Reinforced-alert | |
| General-alert | |
| For Warsaw Pact members: | |
| Increased-ready | Alerting own forces for conflict in Europe, corresponding to increasing levels of combat readiness. |
| Threat-of-war | |
| Combat-ready | |
| For other countries: | |
| Low-alert | Alerting own forces for conflict in Europe, corresponding to increasing levels of combat readiness. |
| Sustain-alert | |
| Full-alert | |
| For all third countries: | |
| On-call | Pre-committing own forces as available for combat in Europe under Red or Blue command. |
| Combatant | Engaging own forces in conventional combat in Europe under Red or Blue command. |
| For nuclear-capable third countries: | |
| Nuc-combatant | Engaging own forces, including the actor's own nuclear weapons, in nuclear and/or conventional combat in Europe. |

Table 2.7

SWASIAN-INVOLVEMENT: COMMITMENT OF FORCES TO SOUTHWEST ASIA

| Value of Variable | Definition |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Disengaged | Having previously committed its forces to non-European conflict, disengaging and withdrawing own forces from foreign locations of conflict. |
| Normal | Not involving the actor's forces in the non-European conflict unless attacked. |
| Low-alert Sustain-alert Full-alert | Alerting own forces for non-European conflict, corresponding to increasing levels of combat readiness. |
| On-call | Pre-committing own forces as available for combat in Southwest Asia under Red or Blue command. |
| Combatant | Engaging own forces in conventional combat in Southwest Asia under Red or Blue command. |
| Nuc-combatant | Engaging own forces, including the actor's own nuclear weapons, in nuclear and/or conventional combat in Southwest Asia under Red or Blue command. |

Table 2.8

NUCLEAR-INVOLVEMENT: INDEPENDENT COMMITMENT OF OWN NUCLEAR FORCES

| Value of Variable | Definition |
|-------------------|---------------------------------------------------------------------------------------------------------------|
| None | Taking no independent nuclear action. |
| Demo-theater | Using small numbers of nuclear weapons independently, hoping to deter attacks against the actor's territory. |
| Theater | Using nuclear weapons independently for military effect in a theater, but not attacking superpower territory. |
| Strategic | Using nuclear weapons independently against the enemy superpower's homeland. |

Use of Third-Country Conventional Forces in the Prewar Phase

As indicated in Tables 2.6 and 2.7, Forces owned by nonsuperpower actors can be put at one of several different levels of readiness, ranging from a peacetime status to fully mobilized and prepared for combat. When a country changes its European, Southwest Asian, or nuclear-involvement⁶ that change is interpreted by the Force Agent as an order, which causes the status of affected forces to change; each specified readiness level has a predefined significance to the Force Agent. Thus, third countries modeled by Green Agent have some flexibility in preparing their armed forces for possible involvement in combat.

Use of Third-Country Conventional Forces in Combat

Countries modeled by Green Agent cannot engage in conventional warfare independently; the Force Agent can process combat orders emanating only from the Red and Blue Agents. Therefore, combat is simulated only for forces under Red or Blue control. While each Green Agent country owns certain forces and these forces are represented in the Force Agent database, their use in combat is simulated only if control over them is yielded by the actor to one or another of the superpowers. This turnover of control is triggered by an involvement of on-call on the part of the nonsuperpower. Only conventional forces are affected by this transfer of control but all of them are resubordinated.

It is possible, however, for an actor to impose some restraints on the use of its forces once it has transferred control of them. The Force Agent allows third-country forces to be restricted in the geographic scope of their activities. For example, Dutch forces might be restricted to fighting in a certain area of Germany corresponding to their NATO corps sector; any elements of the French First Army released to NATO control could be limited to operations in the Central Army Group (CENTAG). The parameters controlling these restrictions are *not* set by Green Agent; they are located in the Force Agent. A default set of

⁶For the remainder of this Note we will use the term involvement as a generic reference to all of these attributes.

restrictions is maintained for most users of the RSAS, and any or all of the parameters may easily be changed by a system user.

In discussing the potential military responses of third-country actors it is important to bear in mind that the RSAS is primarily intended to model confrontation and combat between the superpowers. Thus, while the military options of Blue and Red, and the alliance whose leaderships they represent, are plentiful and sophisticated the same is not true for each third country independently. The RSAS as currently configured is not intended to support studies of conflict between nonsuperpowers (the Iran-Iraq war, for example, or the Anglo-Argentinian clash over the Falklands). The menu of independent military actions which the Green Agent provides is therefore limited. While certainly incomplete, the assumptions underlying the response mechanisms in the Green Agent appear satisfactory when examined in the light of the RSAS's overall purpose.

Use of Third-Country Nuclear Forces in Combat

Nonsuperpowers which possess an independent nuclear capability, such as the United Kingdom, France, and the People's Republic of China (PRC), can choose to use their nuclear assets either in cooperation with their allies or independently. Other nations, such as the FRG, which have dual-key arrangements involving U.S.-owned nuclear weapons can decide when to release those weapons for alliance use.

To use nationally owned nuclear assets cooperatively, an actor can adopt an involvement of nuclear-combatant. In so doing, the country transfers control of all nuclear weapons to its ally, along with control of its conventional forces if it has not already committed them.

Alternatively, a country may use its nuclear forces to launch independent strikes on an enemy: the attribute nuclear-involvement is used to control these actions.

As Table 2.8 shows, there are three levels of autonomous nuclear use available to a nuclear-capable nonsuperpower, ranging from small-scale demonstrative use to a full-scale counter-homeland attack. Since the Force Agent can implement orders received only from the Red and Blue Agents, we use a fairly simple expedient to initiate these strikes.

As implemented, there exist several scripts similar to Red or Blue analytic war plans, which provide instructions to the Force Agent regarding the use of independent nuclear assets. Each owner has several such "execution packages"; the one chosen for use at a given time depends upon both the prevailing situation and the actor's decisionmaking character.

Decision rules within Green Agent trigger the use of these packages by setting a variable or flag in the RSAS data base which in turn prompts a move by the appropriate Major Agent (currently always Blue). When so prompted, the Blue or Red Agent examines the flag for information regarding which strike plan to execute; it then issues the appropriate orders to the Force Agent as though it were the nonsuperpower.

This technical workaround is strongly preferable to alternatives which would undercut the design of the integrated RSAS and complicate its operation by requiring third countries to implement independent military operations.

Disengagement and Surrender

Under certain circumstances countries involved in a conflict may decide to abandon it. Green Agent allows such disengagement to occur.

Depending upon its temperament, a user-specified parameter described later, a nonsuperpower may choose to revert to White, and/or to downgrade its cooperation or involvement levels when particularly severe threats coincide with low effectiveness values.

If the country already has forces involved in combat the Force models will withdraw them from combat should that actor decide to disengage; along with all other nationally owned forces, control of the withdrawn assets will revert to the actor.

Should a disengaging actor have previously allied forces on its territory it will not afterwards treat such forces as invaders, nor is there any mechanism by which it may compel them to leave. There are restrictions built into the Force Agent models, however, which normally prevent any further forces from transiting or overflying a country's territory should its cooperation become disengaged.

The distinction between normal and disengaged is drawn to resolve the problem of distinguishing ordinary peacetime circumstances from those in which an actor has already "fought the good fight" and been compelled to withdraw. Since each invocation of Green Agent is completely independent of all previous ones, an actor moving at some time has no explicit "memory" of what it did at any previous time. Thus, a country finding itself with a normal cooperation could not tell whether it had been at that level throughout the game, or if it adopted that posture after having its army destroyed in combat. The disengaged value of involvement is an attempt to give some "memory" to Green Agent's constituent national actors.

TEMPERAMENTS AND RESPONSE PATTERNS

We have now examined the two external interfaces of Green Agent: the perception structure that interprets data from the outside world and the response rules and variables which transmit information outward. The final subject is the key linkage between these phases, to wit, national temperaments and their associated response patterns. It is via these patterns that an actor's *perceptions* of threat and effectiveness and his awareness of superpower preferences are translated into appropriate *responses*.

There are nine temperaments in the Mark III Green Agent and these are shown in Table 2.9. The table also shows the three general categories into which these temperaments may be divided for conceptual purposes: dependent, reliable, and reluctant.

Dependent Allies

A dependent actor is one whose behavior is contingent solely upon the preferences of its superpower ally. These countries assess neither threat nor effectiveness. They "do as they are told" unless and until they perceive an opportunity to break away from the Soviet Union. If a dependent ally does attempt to exhibit independent behavior its temperament would change to neutral and it would begin behaving accordingly (i.e., determining threat and, when necessary, effectiveness).

Table 2.9

TEMPERAMENTS

| Category | Temperament |
|-----------|--------------------------|
| Dependent | ---- Captive |
| | ---- Satelllite |
| Reliiable | ---- Staunch |
| | ---- Reliable |
| | ---- Moderately-reliable |
| | ---- Initially-Reluctant |
| Reluctant | --- Reluctant |
| | ---- Soft |
| | ---- Neutral |

We have not yet written rules guiding Warsaw Pact dissolution. We expect that certain combinations of circumstances would prompt Red allies to attempt breakaway. Among these we believe the following would be key:

- Red *losing* a war in Europe, or getting *bogged down* there: Such a situation might distract Moscow's attention from alliance difficulties; additionally, military resources which might otherwise be used to put down a heretical ally would likely be otherwise engaged.
- *Absence of Red troops from the country*: This would be especially true in Pact nations which ordinarily shelter large contingents of Soviet forces.

- *Nuclear attack on the Red homeland:* Numerous factors come into play here, including inability of Soviets to react effectively to an alliance revolt and the concern of non-Soviet Warsaw Pact (NSWP) leaderships to limit damage to their own countries.
- *Blue nuclear attacks on non-Soviet targets in the country:* So long as NATO nuclear attacks are limited to Soviet military targets and civilian damage and casualties are limited we expect the NSWP countries to remain loyal. If, however, nuclear strikes spread and urban-industrial sites are targeted, the leaderships of the afflicted nations might consider becoming neutral as a damage-limitation strategy. An additional consideration might be the Soviets' inability to protect their allies from such attacks and, conversely, an equal inability to threaten anything worse as punishment.

These notional rules are obviously quite "soft," and we hope to render them more detailed and complete as the final phases of model development are concluded.

Note, too, that there are two specific temperaments in the dependent subgroup, and they will exhibit different behaviors regarding when and how to break with Red. Captive allies are those, in our judgment like the German Democratic Republic (GDR), which are tied especially closely to the Soviet Union, whether through their own doing or Moscow's. They will "hang tough" longer than would those of satellite temperament such as, perhaps, Poland, which might actively seek an avenue of escape from a superpower confrontation.

Reliable Allies

Four temperaments can be thought of as falling under the rubric of reliable: staunch, reliable, moderately-reliable, and initially-reluctant.

The first three can be thought of as falling into a descending order of loyalty. Staunch actors will not disengage and will only rarely refuse an allied request, whereas reliable ones will desert their ally only under very constrained circumstances and generally agree to superpower preferences. A moderately reliable ally is somewhat more likely to disengage and less so to go along with its ally's urgings but

it is still significantly more reliable than those whose temperaments are classified as reluctant.

Initially reluctant is an interesting case. A nation with an initially reluctant temperament will be slow in responding to its ally until a certain threat threshold is breached. At that point it ceases to behave uncooperatively and becomes more dependable.

This transition is accomplished by designating a breakpoint at which the initially reluctant actor *changes temperament*. Until this threat breakpoint is reached (the default setting in the Green Agent database is grave) the country will behave as a soft ally; afterwards, its temperament becomes reliable.

Both the breakpoint and the before-and-after temperaments are easily modified. This allows an RSAS user to change the outline of an initially reluctant actor's responses without any deep alterations in the code.

Reluctant Allies

The final three temperaments, reluctant, soft, and neutral are considered generically to be reluctant. The former two categories comprise a descending hierarchy of alliance loyalty. A soft actor is more liable to withdraw from a given conflict than a reluctant one and less likely to accede to superpower requests. Either one is significantly less cooperative from its ally's point of view than are any of the reliable types.

Neutral countries stay completely uninvolved in conflicts unless they are subjected to attack. At that point they may join with the superpower that is fighting their attacker under the general maxim that "the enemy of my enemy is my friend." Under certain conditions of threat and effectiveness, however, a neutral country, like its reluctant brethren, will be prone to capitulation.

Response Patterns

Tables 2.10 through 2.15 summarize the various response patterns. In the tables the values for cooperation and involvement shown are the *maximum* attainable under the given conditions of threat and, where applicable, effectiveness. This is true no matter what superpower

request might be present. The actual levels reported following a move would also depend upon the nature and type of allied preferences received.⁷

Dependent allies are not included in these tables since their behavior is not contingent upon the same factors that affect other temperaments. When dependent nations break away from their ally, they take on a neutral temperament and behave accordingly.

Table 2.10

AUTOMATIC RESPONSE TO INDIRECTLY-SERIOUS THREAT
(EFFECTIVENESS NOT A FACTOR)

| Temperament | Maximum Cooperation | Maximum Involvement |
|---------------------|------------------------|------------------------|
| Staunch | Reinforcement | None |
| Reliable | Transit-base | None |
| Moderately-reliable | None | None |
| Initially-Reluctant | None | None |
| Reluctant | None | None |
| Soft | None | None |
| Neutral | None | None |

⁷ The note "effectiveness not a factor" in Tables 2.10, 2.11, and 2.12 indicate that at these threat levels actors do not utilize the effectiveness assessment rules and are instead guided by the rules governing automatic responses. Similarly, the "automatic responses do not apply" comment in Tables 2.13, 2.14, and 2.15 mean that at these threat levels actors do assess effectiveness and their behavior is no longer driven by the automatic response mechanism.

Table 2.11

AUTOMATIC RESPONSE TO SERIOUS THREAT
(EFFECTIVENESS NOT A FACTOR)

| Temperament | Maximum Cooperation | Maximum Involvement |
|---------------------|------------------------|------------------------|
| Staunch | Reinforcement | Low-alert |
| Reliable | Reinforcement | None |
| Moderately-reliable | Transit-base | None |
| Initially-Reluctant | None | None |
| Reluctant | None | None |
| Soft | None | None |
| Neutral | None | None |

Table 2.12

AUTOMATIC RESPONSE TO INDIRECTLY-GRAVE THREAT
(EFFECTIVENESS NOT A FACTOR)

| Temperament | Maximum Cooperation | Maximum Involvement |
|---------------------|------------------------|------------------------|
| Staunch | Cobelligerent | Full-alert |
| Reliable | Reinforcement | Sustain-alert |
| Moderately-reliable | Reinforcement | Low-alert |
| Initially-Reluctant | None | None |
| Reluctant | Transit-base | None |
| Soft | None | None |
| Neutral | None | None |

Leadership Relations

Frequently, national actors are sensitive to the policies and behaviors of regional powers, as well as those of the two superpowers. For example, it can be argued that the various small emirates which line the Persian Gulf (the United Arab Emirates, Qatar, Oman, etc.) are greatly influenced in their decisionmaking by Saudi Arabia. We have attempted to incorporate some sense of these relations between nonsuperpowers into the current Green Agent.

In the model there is a variable called "leader" associated with each actor, which can hold the name of any other nonsuperpower. For example, Qatar's leader would, in the instance above, be Saudi Arabia. This would mean that Qatar would consider Saudi behavior, in addition to threat, effectiveness, and superpower requests, when deciding upon its postures.

As presently configured, the behavior of a "leader" acts as an upper bound on the actions of its followers. That is, Qatar would *never do more* in a given set of circumstances than Saudi Arabia. This feature reflects an assessment that, while a country will not increase risks to itself by becoming involved in a conflict more than its own independent interests would dictate, it will tend to be affected by restraining influences exerted by larger neighboring powers.

Obviously, the limiting effects of leadership relations do not come into play in situations where, for example, the "follower" country is under attack. In such instances where "supreme national interests" are at stake, all actors respond accordingly.

Assertive Status

There is a final attribute of Green Agent countries which affects their response patterns: the variable assertive status. Each actor has associated with it an assertive status of Yes or No. If this status is No, the country's behavior is governed by the nominal response pattern for its temperament. A country defined as Assertive, however, will, in certain extreme circumstances, behave differently.

Table 2.13

RESPONSE TO GRAVE THREAT
(AUTOMATIC RESPONSES DO NOT APPLY)

| Temperament | Effectiveness Level | | | | | |
|---------------------|---------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | High | | Medium | | Low | |
| | Max Coop | Max Involv | Max Coop | Max Involv | Max Coop | Max Involv |
| Staunch | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant |
| Reliable | Nuclear releasor | Combatant | Nuclear releasor | Combatant | Cobel-ligerent | Combatant |
| Moderately Reliable | Cobel-ligerent | Combatant | Cobel-ligerent | Combatant | Rein-forcement | Full-alert |
| Initially Reluctant | Cobel-ligerent | Combatant | Nuclear releasor | Combatant | Cobel-ligerent | Combatant |
| Reluctant | Rein-forcement | Full-alert | Transit-base | Full-alert | None | Low-alert |
| Soft | Coord-inate | Full-alert | None | Low-alert | None | Low-alert |
| Neutral | None | Mobilizing | None | Mobilizing | None | None |

Table 2.14

RESPONSE TO INDIRECTLY-MORTAL THREAT
(AUTOMATIC RESPONSES DO NOT APPLY)

| | Effectiveness Level | | | | | |
|---------------------|---------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | High | | Medium | | Low | |
| | Max Coop | Max Involv | Max Coop | Max Involv | Max Coop | Max Involv |
| Staunch | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant |
| Reliable | Nuclear releasor | Nuclear combatant | Nuclear releasor | Combatant | Cobel-ligerent | Combatant |
| Moderately Reliable | Nuclear releasor | Combatant | None | None | None | None |
| Initially Reluctant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Combatant | None | None |
| Reluctant | Cobel-ligerent | Combatant | None | None | None | None |
| Soft | None | None | None | None | None | None |
| Neutral | None | None | None | None | None | None |

Table 2.15
RESPONSE TO MORTAL THREAT
(AUTOMATIC RESPONSES DO NOT APPLY)

| Temperament | Effectiveness Level | | | | | |
|---------------------|---------------------|------------------------|------------------|------------------------|------------------|-------------------|
| | High | | Medium | | Low | |
| | Max Coop | Max Involv | Max Coop | Max Involv | Max Coop | Max Involv |
| Staunch | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant |
| Reliable | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear releasor |
| Moderately Reliable | Nuclear releasor | Combatant ^a | Cobel-ligerent | Combatant ^a | None | None |
| Initially Reluctant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant | Nuclear releasor | Nuclear combatant |
| Reluctant | Cobel-ligerent | Combatant ^a | Cobel-ligerent | Combatant ^b | None | None |
| Soft | Cobel-ligerent | Combatant ^b | None | None | None | None |
| Neutral | None | None | None | None | None | None |

^aNuclear-releasor/nuclear-combatant if the actor is under nuclear attack.

^bNone/none if the actor is under nuclear attack.

Regardless of the outcome of effectiveness assessment, an Assertive actor which is nuclear-capable will launch a counter-homeland nuclear strike against the aggressor if it is invaded or attacked with nuclear weapons; otherwise, the assertive actor will become a nuclear-releasor.

This parameter is useful for modeling countries such as France, whose declaratory policy of a homeland "sanctuary" can be simulated by assigning to it an assertive status of Yes. Captive and satellite countries always have assertive status set to No.

This completes our discussion of the political-military behavior modeled by the Green Agent. We have outlined the factors affecting the behavior of the nations modeled by the Agent and explained the range of responses which can be evoked. The next section explains the fundamental elements of and rationale for the current Green Agent design.

III. TECHNICAL DESCRIPTION OF GREEN AGENT

In the previous section we described Green Agent in terms of the political-military behavior it models. There, we tried to avoid use of computer programming terminology. In this section we tell why Green Agent is designed as it is. Here, we must use more system programming and computer modeling terminology.

This section has two principal topics. First, we will briefly discuss the design and capabilities of the RSAS war-gaming system and the Rand-Abel computer programming language. With this background, we will then explore a variety of issues related to the design and operation of the Green Agent model itself.

RSAS SYSTEM CAPABILITIES AND CONSTRAINTS

The RSAS war-gaming system provides all necessary support for the operation of the Green Agent. Foremost among these are the Rand-Abel programming language, the World Situation Data Set (WSDS), the Force Agent simulation models, and System Monitor.

The Rand-Abel Programming Language

The Rand-Abel programming language¹ has been developed by the RSAC specifically for use in the Blue, Red, and Green Agents to provide fast execution of English-like, rule-based models in a system that can be transported to computers expected to be available to government users.

Rand-Abel was developed during the Mark III phase of RSAS development. In Mark I and Mark II,² different RSAS models ran on different computers and were programmed in different languages. For

¹The definitive reference on Rand-Abel is Norman Z. Shapiro et al., *The Rand-Abel Programming Language: History, Rationale, and Design*, the Rand Corporation, R-3274-NA, August 1985.

²The Mark I phase extended roughly through 1980. Its purpose was to explore the feasibility of combining desirable features of war-gaming and analytic modeling for the purpose of strategic analysis. The Mark II phase extended from mid-1981 through 1982. Its purpose was to develop conceptual designs for a prototype war-gaming system; Scenario Agent was redesigned in Mark II. Mark III extended roughly from 1983 through 1984. Its purpose was to develop a prototype war gaming system;

example, the Force Agent ran on an IBM 370 computer and was written in PL/1; Scenario Agent ran on a DEC 2060 computer and was written in ROSIE®.³ In Mark III, all RSAS models run on a VAX 11/780 and can be transported⁴ to any computer with sufficient capacity operating under BSD 4.2 UNIX.⁵ Force Agent is written in the C language.⁶ The rest of the RSAS models are written in Rand-Abel, which is built upon C.

As we noted, Rand-Abel gives us capability to write English-like, rule-based models. The rules that characterize rule-based models are generally composed of conditions or sets of conditions which are to be tested and specified actions to be taken contingent upon the results of these tests.

Rule-based activities are a part of everyday life. For example, a common rule among drivers is, "If the gas gauge shows 'nearly empty,' then stop at a gas station; else,⁷ keep going." This reflects an if-then-else structure common to many rule-based systems, including Green Agent.

If-then-else rules provide a powerful way to express complex decisionmaking processes because of their logical structure and the ease with which they can be organized systematically and hierarchically.

Green Agent was recoded into Rand-Abel and partially redesigned in Mark III.

³ROSIE is a trademark of The Rand Corporation. The definitive reference on ROSIE is J. Fain et al., *The ROSIE Language Reference Manual*, The Rand Corporation, N-1647-ARPA, December 1981. ROSIE was used in Mark I and Mark II Scenario Agent because it is a very friendly, interpretive, highly English-like language. ROSIE is a splendid language for quick development (but relatively slow execution) of rule-based models. It was not used in Mark III because we wanted a faster, C-based language.

⁴The phrase "can be transported" does not mean that the RSAS exists on tapes that can immediately be loaded onto other computers. It means that, given a few man-months of effort, the system could be configured to operate on another suitable computer.

⁵UNIX is a trademark of Bell Laboratories. For an introduction to UNIX, see R. Thomas and J. Yates, *A User Guide to the UNIX System*, OSBORNE/McGraw-Hill, Berkeley, California, 1982.

⁶The standard reference on C is B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1978.

⁷Many English speakers would say "otherwise" instead of "else," but the two words have the same English meaning. Computer programmers, some of whom are surprisingly poor typists, prefer the shorter word, "else."

Rand-Abel is a useful language for rule-based models, like Green Agent or the Red and Blue Agents, primarily because it is designed to make the transition from such natural English rules as the gas gauge example to computer-readable code as straightforward as possible.

As an example, let us convert the gas gauge rule to Rand-Abel. We first need to define the types and content of the information we have access to.

In a Rand-Abel system this is the task of the Data Dictionary. There are more than 100 Green Agent variables and attributes in the RSAS Data Dictionary. For this example, however, we will need only one variable, called, say, "automobile," with but two attributes, associated with it: "fuel-level,"⁸ which is expressed in terms of a percentage of some abstract "full" level, and "destination," which can be either "home" or "gas-station." Using these definitions we can translate our English language rule:

If the gas gauge is nearly empty, then stop at a gas station;
else keep heading for home.

into Rand-Abel as:

If the fuel-level of the automobile is less than 0.25⁹
Then Let the destination of the automobile be the gas-station.
Else Let the destination of the automobile be home.

What is immediately apparent from this transformation is the degree to which Rand-Abel resembles English syntax. Thus, one does not have to be a computer programmer to understand this sample rule. This assertion is not true for most other computer languages.¹⁰

⁸A Rand-Abel Data Dictionary entry cannot have blank spaces within it; that's why "fuel-level" is hyphenated.

⁹Alternatively, Rand-Abel allows use of "<" in lieu of "is less than."

¹⁰For example, this rule could be expressed in FORTRAN or BASIC as

```
100 IF (FUELLEV - 0.25) 110,110,120
110 DEST = HOME
115 GO TO 130
120 DEST = GASSTA
130 CONTINUE
```

We should point out, however, that the Rand-Abel language is not identical to English. The "gas gauge" was changed to "fuel-level of the automobile"; "nearly empty" was operationally defined as "less than 0.25"; both "stop at" and "keep heading for" were both (somewhat awkwardly) expressed as "Let the destination of the automobile be."

Rand-Abel is powerful enough to let us express rules in alternative forms. We will illustrate this by restating the gas gauge rule in two other ways. First, we did not need to make the reader implicitly translate "nearly empty" to "less than 0.25." Instead, we could have expressed the Rand-Abel rule as:

```
If the report from Gas-gauge-reading is nearly-empty
Then Let the destination of the automobile be the gas-station.
Else Let the destination of the automobile be home.
```

That would require that we have a Rand-Abel function for Gas-gauge-reading that would explicitly give an operational definition of "nearly-empty." The function could look like this:

```
Define Gas-gauge-reading:
```

```
    If the fuel-level of the automobile is less than 0.25
    Then Exit reporting nearly-empty.
    Else Exit reporting enough-gas.
End.
```

Notice we have not been able to get away with failing to operationally define "nearly-empty"; nearly all computer programs force people to define concepts precisely. (This is often a benefit; it forces us away from fuzzy thinking.) Instead, we "hid" it in the function. There are advantages to this approach. It lets us phrase the rule somewhat more like the original English; it puts the operational definition in one place, from which it may be used by other rules; and it allows us to say more, here to define "enough-gas."

In this last example, we illustrated Rand-Abel's capability to handle hierarchically nested concepts, a very powerful feature letting us write English-like rules with more-than-English-like precision.

An alternative way to express the gas gauge example is with a Rand-Abel decision table:

| <u>gas-gauge-reading</u> | / | <u>destination</u> |
|--------------------------|---|--------------------|
| nearly-empty | | gas-station |
| -- | | home |

Here, the slashes (/) in the heading separate the input variable (gas-gauge-reading) on the left from the output variable (destination) on the right.¹¹ The "--" means "anything else."

The decision table representation is not so English-like as the others, but it is more succinct, is very easy for readers to learn, and frequently discloses oversights that may not be apparent in the other forms of expression. Regarding this last point, notice that the rule assumes the only readings possible are "nearly-empty" or "something-else." What if the reading is "empty"? Then, perhaps, we would want to get over to the right lane or onto the shoulder, contingencies not considered in the original English formulation.

Obviously, this gas-gauge rule is fairly simple. However, most of the rules in Green Agent need not be of much greater complexity. While many have more conditions to be tested or may have several "else" clauses, structurally and logically they are identical to this basic pattern.

To demonstrate a more complicated instance, let us translate this English rule into a possible Rand-Abel counterpart:

Let us imagine a rule that has the FRG mobilize its armed forces if the GDR mobilizes its troops. Further, let us say that we want the FRG to match the level of its mobilization to the GDR's, so that Bonn does not respond to, say, a large Warsaw Pact exercise as if it portended imminent conflict. Finally, we want all NATO countries (including the FRG) to increase the alert level of their troops to the equivalent of the United States' DEFCON 3¹² if the GDR is seen to be mobilizing completely.

¹¹Rand-Abel conventions for writing decision tables are explained more fully in Shapiro et al., op. cit.

The first requirement for creating this rule is the same as that for the simpler example: Define the "information space" in which the rule will operate. Let us suppose that our Data Dictionary defines a variable called "country," which can take as a value the name of any nation. Further, let us assume that there are at least three attributes for each country: "alliance-membership," which can either be "NATO" or "Warsaw-Pact"; "troop-alert-level," whose values are "DEFCON1," "DEFCON2," and so forth; and "force-mobilization-status," which can have a value of "peacetime," "partial," or "full." Using these data we can write the following Rand-Abel rule:

```
If the Mobilization-status of the GDR is full
Then
{
    Let the Mobilization-status of the FRG be full.

    For [every country whose alliance is] NATO
    {
        Let the Alert-status of the country be DEFCON3.
    }
}
Else If the Mobilization-status of the GDR is partial
Then Let the Mobilization-status of the FRG be partial.
Else If the Mobilization-status of the GDR is peacetime
Then Let the Mobilization-status of the FRG be peacetime.
```

This rule demonstrates again that Rand-Abel is not identical to English, but that it is easily learned by English readers who need not be computer programmers. The syntax of this rule is somewhat stilted compared to the English source, but it is still recognizable and understandable.

Notice the use of braces ({ }); their purpose is to group together lines of code (or statements) that are to be executed together. Thus, in this rule, all the rules contained within the outermost pair of braces statement would be executed should that first "If" condition be satisfied (that is, should the mobilization status of the GDR be full).

¹²U.S. Defense Conditions, or DEFCONS, are a measure of the preparedness for war of American armed forces. In peacetime, most U.S. forces are at DEFCON 5; DEFCON 1 represents full preparedness for war.

The "For" statement is also shown here. In this case, it sets up a loop in which each country is tested to determine its alliance membership. If this is found to be "NATO," the statement in the braces is executed; if not, the next country is tested.

Notice that even though there is only one statement within the "For" loop it is surrounded by braces. This is a requirement of Rand-Abel syntax.

Also note the brackets ([]) in the first line of the rule. In Rand-Abel these denote comments, information included for the reader, not the computer. Although Rand-Abel's English-like nature reduces the need for additional documentation, well-chosen comments are still useful aids for understanding, and are necessary for "footnoting" the substantive origins of rules.

Alternatively, these rules could also be expressed in the form of a Rand-Abel table which would relate the GDR's mobilization status to that of the FRG as well as to the alert statuses of NATO nations. Proper use of tables is crucial to the production of clean, comprehensible Rand-Abel code.

These sample rules give a flavor of the capability of Rand-Abel available to Green Agent designers and rule writers.

RSAS System Design

The basic design of the Mark III RSAS is shown in Fig. 3.1.¹³ The current system design rests on two principles. First, the entire software package is compiled as a *single binary*; that is, though written as separate programs, the system is compiled as one program.

The second principle is *modularity*. Each agent was developed independently but in a coordinated fashion to assure compatibility. To ease future development of each model, and to allow system evolution into a *multiple binary* format (where each RSAS element would exist as a separate program and communicate directly with one another), it was

¹³For a full description of the RSAS data management approach and a general discussion of system software, see H. J. Shukiar, *The Rand Strategy Assessment Center System Perspective*, The Rand Corporation, P-6978, June 1984.

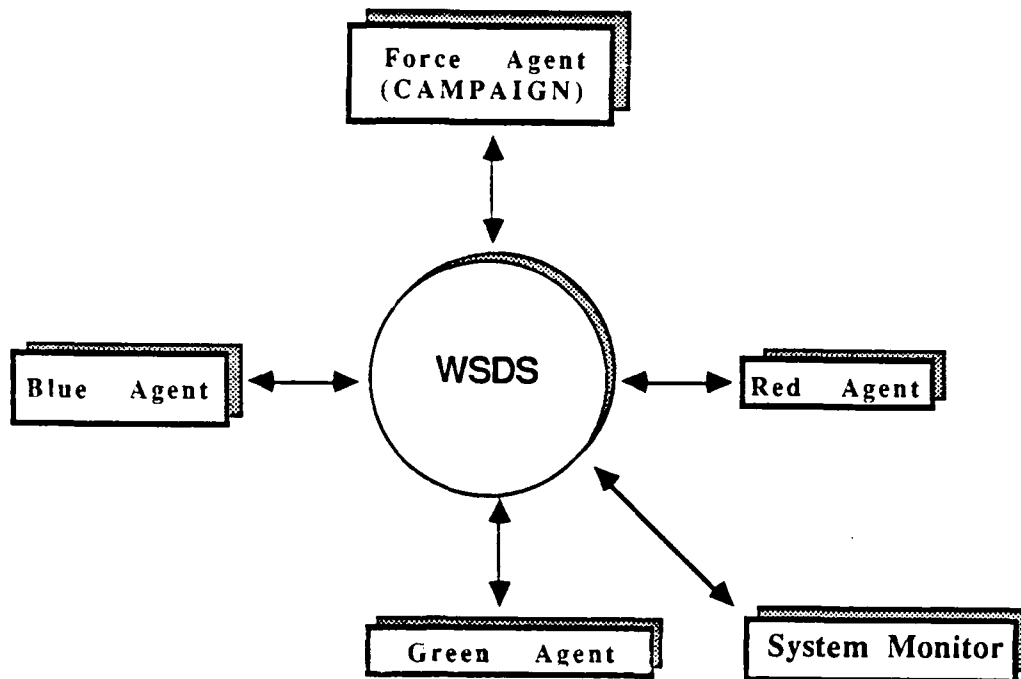


Fig. 3.1 -- RSAS Software Organization

required that they be combined in a manner which did not prevent their reasonably convenient disaggregation.

The primary source of this modularity is the Data Dictionary. All communication between agents occurs via the Data Dictionary and the World Situation Data Set (WSDS). The Data Dictionary, among its other functions, controls access to the various elements of the World Situation Data Set (WSDS) (thus preventing, for example, the Red Agent from "looking at" Blue's war plans, and vice versa), while the agents exchange information by altering items in the WSDS.

There is no direct communication between agents. Rather, they "post" information for one another in the WSDS which the addressee must then read.

As an example, let us imagine a Green Agent move in an RSAS exercise, one immediately following a Blue Agent move. In that cycle, Blue asked the NATO members to mobilize and engage their forces in combat against a Red threat in Europe. Blue did so by calling a function which put a value of "Combatant" in a variable called "US-Preference-for-European-Involvement" for each NATO member. This variable resides in the WSDS and, according to the Data Dictionary, can

be "written on" by the Blue Agent as a means of passing information to Green Agent.

Among the first things the Green Agent does when it "wakes up" to take a turn is check the values of the U.S. and USSR "preference" variables in the WSDS; among these is U.S.-Preference-for-European-Involvement. On this particular move, it finds the "messages" left by Blue asking NATO members to become combatants. This "message" becomes part of each NATO country's perception of the world for that turn and is taken into account in its decisionmaking processes.

After executing their respective decision rules, these NATO countries (and any others that may have moved on this turn) respond by changing other variables in the WSDS. For example, if the United Kingdom chose to act in accordance with American wishes, it would assign a value of "Combatant" to the variable "European-Involvement" associated with the "UK" in the data set. When the Force Agent next awoke, it would look at that variable, among others, to determine what actions were required of it during its cycle. Seeing the "Combatant" value of the UK's "European-Involvement," Force would carry out the appropriate actions with the UK's forces.

Note that all of this reasonably complex behavior took place without any agent *directly* communicating with any other; the "request" from Blue to the UK, and its subsequent "order" to Force were simply changes in a common database, a database controlled by and accessed via the Data Dictionary.

Similarly, notification by System Monitor to prompt Green Agent game moves is by means of changes to WSDS entries. Green Agent sensitivity to these changes is determined by so-called wakeup rules.

The Green Agent is in fact two sets of interrelated Rand-Abel *functions* (analogous to the subroutines of BASIC, FORTRAN, and other computer languages). The first, and smaller, set is composed of Green Agent's wakeup rules; the other, larger, set is the Green Agent proper.

Because the RSAS operates as a single program, only one agent can be executing at a time; all other models wait their turns in the background--they are "asleep." Each agent sets conditions under which it requires a chance to move. These are its "wakeup rules." These

rules reside outside the agents themselves and are tracked by the System Monitor.

Game time in the RSAS is maintained by the Force Agent, which operates in specified cycles determined by current events. These Force cycles represent the minimum possible time between moves for the other RSAS agents. For example, during conventional war, the Force cycle is about two hours. This means that once Force gets control it runs its various functions (e.g., strategic mobility or combat adjudication) for two simulated hours, thereby changing the values of many variables in the WSDS (location of forces, for example, or locations of combat). Force then pauses, allowing the various agents' wakeup rules to be tested against the new world situation. If any rule "fires," that is, if the conditions of any wakeup rule are met, the agent who "left" that rule with System Monitor is "awakened" and control passes to it.

The functions that comprise the Green Agent's wakeup rules monitor the world for such events as superpower requests, the outbreak or spread of war, and the use of nuclear weapons. If any of these should occur, the function "informs" System Monitor (again, by changing data in the WSDS) that Green Agent needs to be awakened.

At this juncture, System Monitor calls the main function of the Green Agent itself. This function in turn calls sequentially a variety of other functions which perform the necessary tasks of the model. Then, the main Green Agent function puts itself back to "sleep" and returns control to the System Monitor. This same basic procedure is followed by all RSAS agents.

There are more than two dozen functions inside Green Agent. Some are dedicated to sifting through the WSDS and, in accordance with rules programmed within them, extracting information relevant to Green Agent's activities. A few others are housekeepers, performing such duties as opening and closing log-files, and reporting any problems that might occur to the System Monitor and the outside world.

By far the majority of code within Green Agent, however, is contained in the functions which simulate the behavior of the nations being modeled. Here, the agent manipulates large quantities of information according to rules embedded in almost three thousand lines of Rand-Abel language code, allowing the model to produce credible,

"intelligent" responses to the evolving situation in the simulated RSAS world.

CURRENT CAPABILITIES AND LIMITATIONS OF GREEN AGENT

The design of the Green Agent involved several principal considerations of design philosophy. First of all, the Mark III version of the model represented an evolutionary growth of the existing Green Agent designed for and used in conjunction with the Mark II RSAS. The goals of the Mark III implementation were:

- To augment the *substantive content* of the model's rule base to enhance its power, flexibility, and robustness; and
- To *reprogram* the model in a newly developed language to render it faster and more efficient.

Additionally, Mark III Green Agent development included the implementation of fundamental changes in the model's design and structure where such alterations were required to achieve the primary ends described above.

All these changes were made with several critical design criteria in mind. The three most important of these concerns were compatibility, plausibility, and flexibility.

Compatibility

Paramount was the need to ensure that Green Agent would interact properly with the other elements of the RSAS. This meant, on a substantive level, that Green Agent could rely only on that information which the system as a whole would be capable of supplying and that it, in turn, must be capable of answering the questions that the other agents would be asking of it.

Such a design criterion may at first glance appear self-evident and trivial, but when one is involved with an information processing system as powerful and complex as the RSAS, it is a challenge to keep this requirement fully in mind. It can become tempting to seek data no other agent is prepared to provide or to provide output no one else is equipped to use.

Additionally, as the RSAS represents an evolving entity, maintaining systemic compatibility can become an extraordinarily complex task in and of itself. It was therefore important to coordinate Mark III Green Agent development closely with the ongoing work in the design and implementation of the other RSAS models, especially the Force Agent and the Red and Blue Agents.

Plausibility

Also important was the requirement that the countries modeled by Green Agent respond to their environment in a plausible fashion. This demanded that care be exercised in the crafting of national "character" and behavior rules to ensure the credibility of the resulting response patterns.

Again, this is an unsurprising requirement, but it is not one that was easily satisfied. Given the wide range of situations the RSAS is intended to explore and the limitations in the amounts and types of data Green Agent could expect to possess at any given time, rules that would prompt coherent and credible nonsuperpower behavior were not easy to fashion.

Many Green Agent rules are quite specific, both as to country (to whom the specific rule applies) and circumstance (what precise elements in the world situation cause it to be executed). Carried to the extreme, however, this specificity would threaten to drown both the designer and the analyst in a torrent of minutiae. Thus, the majority of the rules are more or less general, usually applying to groups of countries and classes of situations. The combination of these two approaches has produced an agent of manageable proportions which behaves in a plausible, realistic manner.

Flexibility

Finally, the broad spectrum of analyses the RSAS is intended to support demands a Green Agent which allows an analyst to choose from a programmed selection of alternative behavior patterns, or to create new ones, if needed. The Mark III Green Agent was designed to include these features.

Green Agent currently incorporates 16 different national characters.¹⁴ An analyst may choose to play any of these national characters for any country in a given game. In addition, there are several key parameters which may be adjusted to modify certain aspects of these patterns.

The rules are written and organized to offer easy modification and expansion. A great deal of this convenience is attributable to the Rand-Abel computer language, the balance deriving from the organization of the rules themselves. Arrayed in modular groupings, such as "Assess Threat," or "Determine Response," rules requiring amplification or modification can be quickly isolated and altered without making extensive changes throughout the entire computer program.

Perception-Response Design and Green Agent Behavior

National decisionmaking processes are unarguably complex. Any attempt to model such processes faces the twofold task of reflecting this complexity and attendant ambiguity while simultaneously resolving it to the extent that patterns of behavior may be distinguished. This process is inherently one of simplification.

One way to develop such heuristic patterns of national behavior is to analyze behavior with an eye towards causal linkages. This type of analysis is the basis of so-called *perception-response modeling*. The second-generation Scenario Agent, which is the progenitor of the version documented in this Note, was based on such a model, and that basic design has been retained.

We can think of third-country decisionmaking as though it consists of sequentially answering the following questions:¹⁵

1. What is the general *temperament* of the country? To what extent is it a "team player"? How reliable is it as an ally?

¹⁴These were discussed in Section II.

¹⁵A similar list appeared in W. Schwabe and L. M. Jamison, *A Rule-Based Policy-Level Model of Nonsuperpower Behavior in Strategic Conflicts*, The Rand Corporation, R-2962-DNA, December 1982, pp. 15-16.

2. To what extent does the country perceive itself *threatened* by the current situation?
3. To what extent does the country believe it would be *effective* in altering favorably the course of the conflict?
4. What *requests* for action have been addressed to the country by either superpower?
5. Which superpower, if any, should the country actively *side* with in the conflict?
6. To what extent, if any, should the country allow its territory to be used by a superpower for purposes related to the conflict; that is, how much should it *cooperate* with its ally?
7. To what extent, if any, should the country *involve* its own armed forces in the conflict?

Questions two, three, and four, regarding threat and effectiveness assessments and expressed superpower preferences, form the *perception* half of the perception-response formula. Question four is answered by information contained in the variable "Temperament," which determines the general *response pattern* of each nonsuperpower being simulated by Green Agent. The answers to questions five, six, and seven (the variables "Side," "Cooperation," and "European/SWAsian/Nuclear-Involvement," in that order) form the *response* of each country, the national behaviors that are the outputs of Green Agent. These responses result from the interactions of the various perceptions with each country's response pattern.

In general, Green Agent rules use two distinct types of system inputs:

- *World Situation Data* which reflect the current state of affairs in the system. Inputs of this type include conflict locations, level of conflict (weapons in use, etc.), relevant allied behavior, and so forth; and
- *Superpower Requests* which express US and Soviet preferences for Green Agent country behavior. The superpower ally of a country might, for example, ask it to involve itself in combat against a mutual enemy, or request basing rights in that nation's territory.

Setting Green Agent's Parameters

Combining the nine basic temperaments with the seven modified versions provided by assertive status yields 16 behavior patterns programmed into Green Agent. This flexibility produces a model of great versatility and power for RSAS applications.

Orientation was described in Table 2.2 as the long-term alignment of a third country. Combined with temperament and assertive status, orientation forms the essential outline of a national character for each nation represented in Green Agent. This trio of attributes, and most especially temperament, are parameters which give an RSAS user the power to adjust the patterns of behavior exhibited by Green Agent across a great variety of alternative choices.

This power can be used to test the sensitivity of planning factors and strategic options to third-party behavior with the maximum of flexibility and replicability. Thus, Red NATO-splitting strategies can be run against several configurations of the Alliance, ranging from rock-solid to soft and vulnerable. The efficacy of early NATO nuclear use under a variety of assumptions regarding alliance solidarity can be examined. On the other side, strategies designed to disrupt Warsaw Pact cohesion could be scrutinized using differing assumptions about non-Soviet Warsaw Pact loyalty. The versatility afforded both the planner and the analyst by the structure of response-patterns in the Mark III Green Agent should prove very useful for many purposes.

Wakeup Rules

Green Agent's wakeup rules are critical to the proper functioning on the model, since it is their output that System Monitor uses to determine whether or not the agent needs to move at any given time. Thus, it is important that these rules cover adequately those conditions which should prompt a response from any one or more of the nations modeled by Green Agent.

At the same time, however, the need to conserve data processing resources argues for a restrictive set of wakeup rules. In general, the RSAS is a large and complex system, capable of consuming immense computational resources. It is thus important to ensure that each

element of the system is as parsimonious as possible in its operation. This consideration was critical to the adoption of Rand-Abel as a programming language for the Red, Blue, and Green Agents. It also figured in the development of the wakeup rules for Green Agent.

Because Green Agent models the behavior of many countries (with more being added as development continues¹⁶) the model cannot run instantaneously as the computationally simpler Red and Blue Agents sometimes can. If allowed to move without sufficient cause, Green Agent operation could unnecessarily expend staff and computer resources.

Additionally, the RSAS itself is a constrained multi-player game whose purpose is to examine superpower conflict. Green Agent forms part of the background for such studies and although their roles are crucial to the analytic legitimacy of the system, the countries it models are not the center of attention, nor are they individually at least the most influential players. This again is an argument for using the Green Agent economically--using it to provide a credible and dynamic context in which Red and Blue may play out their activities. It is important that Green Agent actions not obscure the results of an exercise nor impede its progress.

Thus, the Green Agent wakeup rules are few in number, but broadly applicable. They are designed to prompt nonsuperpower actions at points where such actions are not only likely but useful and significant to the analytic purposes of the RSAS.

There are four criteria employed by the Green Agent's wakeup rules. First, a rule will fire if any Red or Blue requests to third countries are present which were not in evidence the last time the wakeup rules were polled (the last "polling phase"). This ensures timely response to the Red and Blue Agents' needs. Note that requests in the internal Green Agent queue (put there after previously being considered and refused by their target countries) do not cause this "request flag" to act. Such requests are thought to be "on the back burner" and will be

¹⁶For example, currently the only Latin American country in the Green Agent database is Panama which is included because of the strategic significance of the Canal Zone. As the RSAS reaches maturity it is almost a foregone conclusion that more attention will be paid to this region of the globe; Green Agent will need to expand to accommodate such studies.

reconsidered only when the target countries are awakened due to a new development in the global situation or on the next day.

Second, Green Agent will require a move if any nonsuperpower has come under attack since the last polling phase. This is accomplished by examining information provided by the Force Agent regarding military activity in each country. Any attack, ranging from a limited conventional bombardment or border incursion to a full-scale invasion or hostile use of nuclear weapons, is covered by this rule. A continuing conflict (that is, one which was in progress at the last polling phase) will not trigger this rule unless it has since escalated to the nuclear level. This represents a third Green Agent wakeup condition: initial use of nuclear weapons within a given country's borders.

Finally, a fourth wakeup rule constitutes a sort of "catch-all" for important events which could slip between the cracks of the other three criteria. This is a rule which requests a Green Agent move every 24 hours whenever there is ongoing superpower conflict anywhere in the globe. This generic rule eases the requirement for a virtually infinite quantity of specific ones needed to cover a broad spectrum of contingencies. For example, in a Central European war it might be expected that Belgium would react if combat in the FRG was rapidly moving west. Rather than write a rule or rules to cope with this phenomenon, we simply let Belgium assess its situation every day.

Need-to-Act Criteria

For the same reasons of efficiency outlined above, Green Agent moves in a given turn only a subset of the countries it models. The selection is rule-driven and is made according to criteria very similar to those involved in the wakeup rules. Once Green Agent itself has awakened, it determines which country or countries

- have Red or Blue requests pending (here including any requests waiting in the internal queue), or
- are under any sort of attack, conventional or nuclear, or
- have forces actively involved in combat anywhere in the world, or

- are in a region where conflict is ongoing, or
- have enemy forces mobilizing on its borders.

Those countries meeting one or more of the above conditions will be put through a decisionmaking cycle during this move.

Time Delays

The Mark II Green Agent incorporated a fairly complex scheme for delaying third-country response to superpower preferences; this was done in recognition of the many time lags which afflict real-world decisionmakers. These delays represented both the time required by the target government to organize itself to respond and to make the actual decision, and also more subtle effects: the time penalty imposed indirectly by a target nation unwilling or unable to address the issue raised, for example. These two phenomena are fairly distinct, and in the Mark III model we have chosen to deal with them as separate issues.

The former source of delay, the "noise in the loop" problem, is very closely related to command, control, and communications (C³) processes which in the RSAS are modeled by the Force Agent. They do not represent the result of a *conscious national decisionmaking process*, and hence are not in the bailiwick of Green Agent, strictly speaking.

However, the length of these delays will be affected by factors assessed by Green Agent; for example, if a decision arises at a time of crisis, the necessary decisionmakers will probably be more readily available and prepared for their task than might be the case if the need for response arose "out of the blue." Further, since the effects of this process are in RSAS terms found in a delay between a country's receipt of a request and its response, depicting the phenomenon is very much a task for Green Agent.

We have devised a methodology to implement this type of decision delay, one that allows appropriate interaction between the delay-generation process and the Green Agent decisionmaking loop while segregating the two for purposes of clarity of design.¹⁷

¹⁷That is, as outlined above, Green Agent is concerned with decision processes of national actors, while the Force Agent is tasked

A Rand-Abel decision table is used to compute a delay for each request received by a nonsuperpower. This table takes into account the nature of the request (is the country being asked to allow simple transit basing rights, or to go to war?), the character of the ally (does it tend to be a more or less loyal ally to the superpower?), and the general urgency of the circumstances (as measured by the threat the country perceives itself as facing). The resulting delay, ranging from an hour to a few days, is added to the time at which the request was received, with the sum, representing some time in the future, being used as a "response deadline."

A list of all current deadlines is maintained, with the variable "Earliest-response-time" storing the earliest of them. Every time the Green Agent wakeup rule checking for superpower requests is run, this variable will be interrogated. If its value is less than or equal to the time at which the test is made the rule will generate a Green Agent wakeup.

Additionally, at every Green Agent move between the time a request was received and the expiration of its response deadline, the delay time assigned to every request will be reviewed. If the situation has changed enough to prompt a different delay (either shorter or longer) a new delay is assigned to that request and a new response deadline is registered.

Requests are treated on a first-come, first-served basis. Thus, if any request is superseded before its designated delay has expired (for example, a new preference for cooperation arrives before the previous one has been considered), the new request will be assigned its own delay and the original preference will be responded to first.

After the rule-determined delay has expired, countries respond immediately to any requests they are presented with. If their evaluation of the world situation merits a positive answer they provide one; if not, the preference is refused.

with modeling, among other things, command and control. Since this problem in effect bridges the distinction, it was thought important that it not be resolved strictly internally to either module. Instead, it sits outside all other RSAS agents while interacting (potentially) with each of them; this preserves functional distinctions between the various models.

An innovation in the new Green Agent is a "request queue." All refused requests are entered in this queue and stored there. At every Green Agent move following the initial refusal, the request is presented again to the appropriate country until it is either acceded to or superseded by a new superpower preference of the same type (cooperation, involvement, etc.).

An example will help clarify the utility of this mechanism in simulating delaying behavior. At time 0, Blue asks France to begin mobilizing her forces for a possible war in Central Europe. When that request is received by Green Agent, it is first processed through the delay table explicated earlier, which assigns to it a delay of, say, 12 hours.

At $t + 12$ hours, then, France is presented with the mobilization request. Assessing its situation, it decides not to comply. The request is transferred to the queue, where it is stored until the next Green Agent move cycle; at that time, it is reevaluated by the model. This process repeats until the request is either agreed to or replaced by a new superpower preference.

At $t + 7$ days Red attacks the FRG. The French at this juncture decide to mobilize in accordance with Blue's previous wishes. The request is now removed from the queue.

This method of handling time delays accomplishes several goals: it relieves Red and Blue of the responsibility for reissuing refused preferences, it explicitly models "noise in the loop" delays, effectively simulates alliance "foot-dragging," and does all three efficiently.

Rule Augmentation

Some features of Green Agent are less highly developed than others. For example, although effectiveness assessment is an integral part of the model, its rules are not elaborate and may be viewed as but a marker for future development. Many political and military factors may be as important to effectiveness assessment as those we have included. Such factors might include issues of alliance solidarity, prospects for direct aid from one's superpower ally, or domestic political considerations.

When future analysis, study requirements, or war-gaming experience indicate the need to augment Green Agent rules, the ease of rule augmentation will largely depend on whether the change makes demands on RSAS models other than Green Agent. Simple changes can be made in minutes or hours; however, rules dependent on data not then in the WSDS will be more difficult. If, for example, a particular study required effectiveness assessment that was sensitive to civilian casualties, the rules needed to effect such a change would depend on measures of casualties extracted from the WSDS. Force Agent does not now simulate civilian casualties; therefore, the information is not in the WSDS. A Green Agent rule writer would have to write a function to derive an estimate of civilian casualties from available data, or a Force Agent modeler would have to add logic to simulate casualties.

CONCLUSION: PROSPECTS FOR FUTURE DEVELOPMENT

The current version of the Green Agent represents an evolutionary outgrowth of its two predecessors. It does not, however, represent the end of the model's development. The two primary tasks of the effort documented here, augmentation of the model's rule-base and computational streamlining, are ongoing. As the RSAS acquires a more global perspective, for example, new threat assessment rules will be needed to deal with new theaters of conflict. There is a need for further work on the effectiveness assessment procedure and the rules governing both Warsaw Pact and NATO alliance dynamics. Some variety of negotiation between the superpowers and their smaller allies needs to be implemented. Users of the RSAS will undoubtedly point out other areas where the Green Agent is deficient to one extent or another. We have attempted to incorporate sufficient flexibility in the model's design to comfortably accommodate such changes; the ongoing development of the Green Agent will parallel the continuing evolution of the RSAS as a whole.

APPENDIX A: SOURCE CODE FOR GREEN AGENT¹

```
[          ***** GREEN AGENT *****          ]

[      Code written and maintained by David A. Shlapak (randvax!david)      ]

[      Last Modified: 29 July 1986      ]

[          **** INTRODUCTION ****          ]

[ This is the Rand-Abel code for the Green Agent, the Rand Strategy ]
[ Assessment System's model of nonsuperpower behavior in U.S./Soviet ]
[ conflict. The model is completely described in D. Shlapak et al., ]
[ The Rand Strategy Assessment System's Green Agent Model of Third- ]
[ Country Behavior in Superpower Crises and Conflict, N-2363-1-NA, ]
[ September 1986. ]

[ Rand-Abel is a high-level computer language based upon the popular ]
[ C programming language. It is designed to be human- as well as ]
[ machine-readable. In addition, Rand-Abel is highly flexible, allowing ]
[ changes in programs to be made quickly and with relative ease. ]

[ Green Agent is a rule-based model of national behavior; that is, the ]
[ program consists largely of "If-Then" type statements. A fuller explanation ]
[ of what is meant by rule-based modeling may be found in the documentation. ]

[ The code is organized in four sections. This first part consists of ]
[ commentary (that is, nonmachine readable text) intended to provide an ]
[ introduction to the rather complex program which follows. Please note that ]
[ all text enclosed in brackets, as are these paragraphs, are ]
[ comments and are not processed by the computer. They are strictly for ]
[ the benefit of the human reader. ]

[ The second section contains Green Agent's "wakeup rules," used by the ]
[ RSAS System Monitor to determine whether or not Green Agent requires ]
[ a turn at any given moment in game play. ]
```

¹The code is intended to be easily changed. As a result, many of the rules shown here are merely illustrative for the purposes of a prototype.

```
[ The third part contains the "master control" and "housekeeping" elements,  
  or "functions," of Green Agent.  
]
```

```
[ The fourth and final section contains the substantive rules which drive  
  the behavior of the nonsuperpower countries which are modeled by Green  
  Agent. These rules represent by far the bulk of the code and will  
  probably be of the greatest interest to most observers.  
]
```

```
[*****]
```

```
[ Please note that the program which follows is not wholly consonant with  
  the model as documented in Shlapak et. al. cited above. Currently, the  
  RSAS 1.0 exists in a prototype state, and some features required  
  to support certain elements of Green Agent operation are not yet  
  available.  
]
```

```
[ Thus, the code which follows does NOT reflect the following documented,  
  but as yet unimplementable, aspects:
```

- o Independent nuclear use.
- o Decision delays.

```
]
```

```
[*****]
```

```
[ The following functions contain Green Agent's wakeup rules. ]
```

```
[*****]
```

Define Current-wakeup:

```
[ This is the function called by System Monitor when it polls Green Agent's  
  wakeup rules. It in turn calls other functions which test the rules  
  themselves. Returning '1' to Monitor indicates that Green Agent wishes  
  to move; returning '0' indicates that it need not be awakened at this time.  
]
```

```
Let Green-wake-flag be the report from Check-Green-script.  
Let Action-wake-flag be the report from Check-action-script.
```

```
If (Green-wake-flag is Yes) or (Action-wake-flag is Yes)  
Then Exit reporting Yes.
```

```
If report from Request-flag is Yes  
Then Exit reporting Yes.
```

```
Else If report from Conflict-flag is Yes  
Then Exit reporting Yes.
```

Else If Report from Daily-wake-during-war is Yes
Then Exit reporting Yes.

Exit reporting No.

End.

Define Request-flag:

[This function checks to see if either superpower has made a request of
any Green Agent country since the last Green Agent move. If so,
Green Agent needs to move once more.
]

For every Country:

```
{
  If the Player-status of the Country is Yes
  Then
  {
    If
    (
      report from Check-for-superpower-requests using
      Country as actor, and Yes as wakeup-flag
    )
    is Yes
    or
    (( report from Check-for-pending-preferences using
      Country as actor
    )
    is Yes
    and
    (Monitor's Game-days is at least Last-time + 2 [days]))
    )
    Then Exit reporting Yes.
  }
  Else.
}
Exit reporting No.
```

End.

To Conflict-flag:

[This function determines whether or not conflict has spread into a country
from which it previously was absent. Further, it checks whether previously
conventional conflict has escalated into nuclear use. Either situation
will require a Green Agent move.
]

[Ask-force-country is a "force query" function. That is, it is used by Red,
Blue, and Green Agents to gain information from CAMPAIGN's
part of the World Situation Data Set (WSDS). Numerous such functions are

used by Green Agent; all of them have names beginning with "Ask-,"
such as "Ask-force-country."

]

Declare status by example: Let status of Country be Type-weapons-level.

For every Country:

{

 If the Player-status of the Country is Yes

 Then

 {

 Let status of Country be

 (report from Ask-force-country-status using Country as country).

 If status of Country is greater than Peace

 Then

 {

 If the Conflict-location-status of Country is not Conv

 and the Conflict-location-status of Country is not Nuclear

 Then Exit reporting Yes.

 }

 If status of Country is Nuclear

 Then

 {

 If the Conflict-location-status of Country is not Nuclear

 Then Exit reporting Yes.

 }

 }

 Else Continue.

}

Exit reporting No.

End.

To Daily-wake-during-war:

[This function is designed to ensure that Green Agent gets at least one
move per day when there is ongoing superpower conflict in the world. This
is done as a surrogate for a number of highly complicated and specific
rules (i.e. Belgium needs to move because the FLOT is now too close for
comfort) which would otherwise be required.

]

 If Last-time is less than 0

 Then Let Last-time be -1.

 If Monitor's Game-days is at least (Last-time + 1)

 and

 {

 the report from Ask-force-arena-data

```

        using Avg-FLOT-rate as data, and WTVD as arena
    )
    is greater than 5
    Then Exit reporting Yes.
    Else Exit reporting No.

End.
```

```

[      This concludes the set of Green Agent wakeup rules.      ]

[*****]

[ This is the beginning of the third portion of this code, which contains
  various control functions.
]

[ The following functions, Green-startup and Green-agent, are the heart
  of the model. Green-startup is the function invoked by System Monitor
  to begin a Green Agent move. Green-startup first of all sets up
  the appropriate wakeup functions for the model (the code for which is
  above). It then invokes the next function, Green-agent. This function
  works by calling in a specified order a series of other functions which
  perform the tasks associated with Green Agent's role in the RSAS. At
  the conclusion of this activity, Green-agent returns control to
  Green-startup, which in turn yields control of the game to System
  Monitor.
]

[*****]
```

Define Green-startup:

```

    Perform Add-wakeup using self as process and
        procedure Current-wakeup as wakeup-rule.

    While Yes:
    {
        Perform Sleep.

        [ If Scenario Generator wakeup, issue next output ]

        Perform Force-parameter-script.

        If Green-wake-flag is Yes
        Then Perform Do-scripted-Green-events.

        If Action-wake-flag is Yes
        Then Perform Do-scripted-actions.

        If (Action-wake-flag is No) and (Green wake-flag is No)
        Then
```

```
{
    Perform Determine-action-status.
    Perform Determine-involvements.
    Perform Determine-conflict-levels.

    Perform Green-agent.
}

Let Green-wake-flag be No.
Let Action-wake-flag be No.
}

End.

[ ***** ]

Define Green-agent:

    Perform Do-beginning-housekeeping.
    Print Log-file "Green Agent 1.0".
    Perform Flush-stream Log-file.
    Perform Setup-force-data.
    Perform Setup-preferences.
    Perform Setup-new-preferences.
    Perform Determine-situation.
    Perform Log-preamble.
    Perform Decide-postures.

    If All-done is Yes
    Then Perform Clear-preferences.

    If the Leader of the Actor is not Unspecified
    Then Perform Follow-leader.

    Perform Check-for-call.

    Perform Determine-alliance-involvement.

    [ Perform Communicate-force-orders. ]

    Perform Do-ending-housekeeping.

End.

Define Do-beginning-housekeeping:

[ This is a utility function which sets up the proper values of some Green
  agent control variables.
]
```

Perform Setup-preferences.

Let the Present-time be Monitor's Game-days.

End.

To Setup-force-data:

[This function uses a variety of force queries (see above) to gather information necessary to the proper operation of the rules which follow. Note that in most cases this information is not used "raw"; rather, it is translated into appropriate values of a variety of variables.
]

[Among the data acquired by this function are the conflict status of every country, the level of armed superpower presence, if any, in each country, the location and speed of the FEBA in Central Europe, and the extent to which either superpower is actively involved in combat anywhere in the world.
]

Declare blue-forces by example: Let blue-forces be 1.0.
Declare red-forces by example: Let red-forces be 1.0.
Declare red-total by example: Let red-total be 1.0.
Declare blue-total by example: Let blue-total be 1.0.
Declare status by example: Let the status of Type-country be
 Type-weapons-level.

[This first block of code sends certain instructions to CAMPAIGN the first time Green Agent runs which set up a canonical set of geographic restrictions on the use of third-country forces. For example, Polish forces will only fight on the northern two axes of the WTVD theater, Belgian forces will remain in their corps sector, and so on.
]

If Monitor's Game-days is less than 1
Then
{

Log Log-file "Sending restrict orders."
Table Restrict-combat-order

| <u>govt</u> | <u>permit-deny</u> | <u>arena</u> | <u>axis</u> |
|----------------|--------------------|--------------|-------------|
| Poland | Deny | WTVD | all |
| Poland | Permit | WTVD | WTVD-1 |
| Poland | Permit | WTVD | WTVD-2 |
| Czechoslovakia | Deny | WTVD | all |
| Czechoslovakia | Permit | WTVD | WTVD-9 |
| Czechoslovakia | Permit | WTVD | WTVD-10 |
| GDR | Deny | WTVD | all |
| GDR | Permit | WTVD | WTVD-1 |
| GDR | Permit | WTVD | WTVD-2 |

| | | | |
|-------------|--------|------|---------|
| GDR | Permit | WTVD | WTVD-9 |
| GDR | Permit | WTVD | WTVD-10 |
| USSR | Permit | WTVD | all |
| USSR | Deny | WTVD | WTVD-1 |
| USSR | Deny | WTVD | WTVD-2 |
| USSR | Deny | WTVD | WTVD-9 |
| USSR | Deny | WTVD | WTVD-10 |
| Denmark | Deny | CEUR | all |
| Denmark | Permit | CEUR | CEUR-1 |
| Belgium | Deny | CEUR | all |
| Belgium | Permit | CEUR | CEUR-5 |
| Netherlands | Deny | CEUR | all |
| Netherlands | Permit | CEUR | CEUR-2 |
| UK | Deny | CEUR | all |
| UK | Permit | CEUR | CEUR-4 |
| Canada | Deny | CEUR | all |
| Canada | Permit | CEUR | CEUR-8 |
| France | Deny | CEUR | all |
| France | Permit | CEUR | CEUR-7 |
| France | Permit | CEUR | CEUR-8 |
| France | Permit | CEUR | CEUR-9 |
| France | Permit | CEUR | CEUR-10 |
| FRG | Deny | CEUR | all |
| FRG | Permit | CEUR | CEUR-2 |
| FRG | Permit | CEUR | CEUR-3 |
| FRG | Permit | CEUR | CEUR-5 |
| FRG | Permit | CEUR | CEUR-6 |
| US | Permit | CEUR | all |
| US | Deny | CEUR | CEUR-1 |
| US | Deny | CEUR | CEUR-9 |
| US | Deny | CEUR | CEUR-10 |

}

[Now we ask CAMPAIGN to tell us the number of Red and Blue controlled troops
in each Green Country.

]

For every Country:

{

 If the Player-status of the Country is Yes

 Then

 {

 Let blue-forces be

 (

 report from Ask-force-country-data using

 Blue as side, Total-EDs as data, and Country as country

).

 Let red-forces be

 (


```
report from Ask-force-country-data using
  Red as side, Total-EDs as data, and Country as country
).
```

```
If blue-forces is at least 2.0
Then Let Blue-presence of Country be Major.
Else If blue-forces is at least 1.0
Then Let Blue-presence of Country be TripW.
Else If blue-forces is greater than 0.0
Then Let Blue-presence of Country be Token.
Else If blue-forces is 0.0
Then Let Blue-presence of Country be None.
```

```
If red-forces is at least 2.0
Then Let Red-presence of Country be Major.
Else If red-forces is at least 1.0
Then Let Red-presence of Country be TripW.
Else If red-forces is greater than 0.0
Then Let Red-presence of Country be Token.
Else If red-forces is 0.0
Then Let Red-presence of Country be None.
```

```
[ Now we determine the conflict-status of each country... ]
```

```
Let the status of Country be
(
  report from Ask-force-country-status using Country as country
).
```

```
If status of Country is Unspecified
Then Log Log-file Country " has unspecified status.".
Else If status of Country is Peace
Then Let the Conflict-location-status of the Country be None.
Else If status of Country is Limited
  or status of Country is Conventional
Then Let the Conflict-location-status of the Country be Conv.
Else If status of Country is Nuclear
Then Let the Conflict-location-status of the Country be Nuclear.
```

```
}
}
```

```
[ ...the two superpowers... ]
```

```
For Country (US or USSR):
```

```
{
  Let the status of Country be
  (
    report from Ask-force-country-status using Country as country
  ).
```

```
If status of Country is Unspecified
Then Log Log-file Country " has unspecified status.".
```

```
Else If status of Country is Peace
Then Let the Conflict-location-status of the Country be None.
Else If status of Country is Limited
    or status of Country is Conventional
Then Let the Conflict-location-status of the Country be Conv.
Else If status of Country is Nuclear
Then Let the Conflict-location-status of the Country be Nuclear.
}
```

[...and each Region

]

```
If
(
    report from Ask-force-theater-status using
        Northern-Europe as theater is Nuclear
)
or
(
    report from Ask-force-theater-status using
        Central-Europe as theater is Nuclear
)
or
(
    report from Ask-force-theater-status using
        Southern-Europe as theater is Nuclear
)
Then Let the Conflict-status of Europe be Nuclear.
Else If
(
    report from Ask-force-theater-status using
        Northern-Europe as theater is at least Limited
)
or
(
    report from Ask-force-theater-status using
        Central-Europe as theater is at least Limited
)
or
(
    report from Ask-force-theater-status using
        Southern-Europe as theater is at least Limited
)
Then Let the Conflict-status of Europe be Conv.
Else Let the Conflict-status of Europe be None.
```

```
If
(
    report from Ask-force-theater-status using
        Southwest-Asia as theater is Nuclear
)
```

[
or

```
(
    report from Ask-force-theater-status using MEast as theater is Nuclear
)
]
Then Let the Conflict-status of SWAsia be Nuclear.
Else If
(
    report from Ask-force-theater-status using
        Southwest-Asia as theater is at least Limited
)
[
    or
    (
        report from Ask-force-theater-status using MEast as theater is
            at least Limited
    )
]
Then Let the Conflict-status of SWAsia be Conv.
Else Let the Conflict-status of SWAsia be None.

[
    If
    (
        report from Ask-force-theater-status using FEast as theater is Nuclear
    )
    Then Let the Conflict-status of Asia be Nuclear.
    Else If
    (
        report from Ask-force-theater-status using FEast as theater is
            at least Limited
    )
    Then Let the Conflict-status of Asia be Conv.
    Else
]
Let the Conflict-status of Asia be None.

If Conflict-location-status of Canada is Nuclear
or Conflict-location-status of US is Nuclear
Then Let the Conflict-status of North-America be Nuclear.
Else If Conflict-location-status of Canada is Conv
or Conflict-location-status of US is Conv
Then Let the Conflict-status of North-America be Conv.
Else Let the Conflict-status of North-America be None.

[ The four functions called next determine the level of conflict in each of
the two chief regions and the extent of superpower involvement therein.
]

Perform Check-blue-European-weapons.

Perform Check-red-European-weapons.
```

Perform Check-blue-SWAsian-weapons.

Perform Check-red-SWAsian-weapons.

If
 (
 the report from Ask-force-strategic-data using
 Red as side, and Used-warheads as data
)
 is not 0
Then Let the Intercontinental-weapons-type of Red be Nuclear.
Else Let the Intercontinental-weapons-type of Red be None.

If
 (
 the report from Ask-force-strategic-data using
 Blue as side, and Used-warheads as data
)
 is not 0
Then Let the Intercontinental-weapons-type of Blue be Nuclear.
Else Let the Intercontinental-weapons-type of Blue be None.

[to determine FEBA-location, the following instructions are executed.]

Let FEBA-location be
 (
 report from Ask-force-arena-data
 using Avg-FLOT-location as data, and WTVD as arena
).

[to determine ADE ratio, the following instructions are executed.]

Let red-total be
 (
 report from Ask-force-theater-data using
 Red as side, Total-EDs as data, and Central-Europe as theater
).

Let blue-total be
 (
 report from Ask-force-theater-data using
 Blue as side, Total-EDs as data, and Central-Europe as theater
).

If (blue-total > 0)
Then Let ADE-ratio be red-total / blue-total.
Else Let ADE-ratio be red-total.

[Now we test for Border-Mobilization against key NATO countries.]

If
 (

```

    the report from Ask-force-country-data using
      Red as side, Mobilized-EDs as data, and GDR as country
  )
  is at least 22
Then
{
  For Country (Austria or FRG or Denmark):
  {
    Let the USSR-border-mobilization-status of the Country
      be Yes.
  }
}

If
(
  the report from Ask-force-region-data using
    Red as side, Mobilized-EDs as data, and USSR-Cen-Asia as region
  is at least 6
)
or
(
  the report from Ask-force-country-data using
    Red as side, Mobilized-EDs as data, and Afghanistan as country
  is at least 16
)
Then Let the USSR-border-mobilization-status of Iran be Yes.

Let the Blue-presence of US be Major.
Let the Red-presence of US be None.

Let the Blue-presence of USSR be None.
Let the Red-presence of USSR be Major.

End.

To Check-blue-European-weapons:

[ This function, and the three which follow, define the extent of weapons
  usage in Europe and the Middle East (Southwest Asia) by each of the
  superpowers.
]

If
(
  report from Ask-force-theater-status using Central-Europe as theater
)
  is Nuclear
Then
{
  Let European-weapons-type of Blue be Nuclear.
  Let European-involvement of US be Nuc-combatant.
  Exit.
}
```

```

}
Else If
(
    report from Ask-force-theater-status using Central-Europe as theater
)
    is at least Limited
Then
{
    Let European-weapons-type of Blue be Conventional.
    Let European-involvement of US be Combatant.
    Exit.
}
Else
{
    Let European-weapons-type of Blue be None.
    Let European-involvement of US be Normal.
    Exit.
}

End.

To Check-blue-SWAsian-weapons:
```

```

If
(
    report from Ask-force-theater-status using Southwest-Asia as theater
)
    is Nuclear
Then
{
    Let SWAsian-weapons-type of Blue be Nuclear.
    Let SWAsian-involvement of US be Nuc-combatant.
    Exit .
}
Else If
(
    report from Ask-force-theater-status using Southwest-Asia as theater
)
    is at least Limited
Then
{
    Let SWAsian-weapons-type of Blue be Conventional.
    Let SWAsian-involvement of US be Combatant.
    Exit.
}
Else
{
    Let SWAsian-weapons-type of Blue be None.
    Let SWAsian-involvement of US be Normal.
    Exit.
}
}
```

End.

To Check-red-European-weapons:

```
If
  (
    report from Ask-force-theater-status using Central-Europe as theater
  )
  is Nuclear
Then
{
  Let European-weapons-type of Red be Nuclear.
  Let European-involvement of USSR be Nuc-combatant.
  Exit.
}
Else If
  (
    report from Ask-force-theater-status using Central-Europe as theater
  )
  is at least Limited
Then
{
  Let European-weapons-type of Red be Conventional.
  Let European-involvement of USSR be Combatant.
  Exit.
}
Else
{
  Let European-weapons-type of Red be None.
  Let European-involvement of USSR be Normal.
  Exit.
}
```

End.

To Check-red-SWAsian-weapons:

```
If
  (
    report from Ask-force-theater-status using Southwest-Asia as theater
  )
  is Nuclear
Then
{
  Let SWAsian-weapons-type of Red be Nuclear.
  Let SWAsian-involvement of USSR be Nuc-combatant.
  Exit.
}
Else If
  (
    report from Ask-force-theater-status using Southwest-Asia as theater
  )
```

```
        is at least Limited
Then
{
    Let SWAsian-weapons-type of Red be Conventional.
    Let SWAsian-involvement of USSR be Combatant.
    Exit.
}
Else
{
    Let SWAsian-weapons-type of Red be None.
    Let SWAsian-involvement of USSR be Normal.
    Exit.
}

End.

Define Setup-preferences:

[ The purpose of this routine is to allow the generalization of the
  rulesets so rules do not have to be duplicated to handle US and USSR
  preferences.
]

Declare super-power by example: Let super-power be Type-country.

For super-power (US or USSR):
For every Country:
{
    Let the Preference-for-side of the super-power and the Country be
        Unspecified.

    Let the Preference-for-cooperation of the super-power and the Country
        be Unspecified.

    Let the Preference-for-SWAsian-involvement of the super-power and
        the Country be Unspecified.

    Let the Preference-for-European-involvement of the super-power and the
        Country be Unspecified.
}

For every Country:
{
    Let the Preference-for-side of the US and the Country be the
        US-preference-for-side of the Country.

    Let the Preference-for-cooperation of the US and the Country be the
        US-preference-for-cooperation of the Country.

    Let the Preference-for-SWAsian-involvement of the US and the
        Country be the US-preference-for-SWAsian-involvement of the
        Country.
```


Let the Preference-for-European-involvement of the US and the Country
be the US-preference-for-European-involvement of the Country.

Let the Preference-for-side of the USSR and the Country be the
USSR-preference-for-side of the Country.

Let the Preference-for-cooperation of the USSR and the Country be the
USSR-preference-for-cooperation of the Country.

Let the Preference-for-SWAsian-involvement of the USSR and
Country be the USSR-preference-for-SWAsian-involvement of the
Country.

Let the Preference-for-European-involvement of the USSR and the
Country be the USSR-preference-for-European-involvement of the
Country.

}

End.

Define Setup-new-preferences:

{ This function is part of the request-queue mechanism. It places pending
preferences into line for fresh consideration if they have not been
superseded by new requests from the superpowers.
}

Declare super-power by example: Let super-power be Type-country.

For super-power (US or USSR):

For every Country:

{

If the Player-status of the Country is Yes

Then

{

If the Preference-for-side of the super-power and Country is Unspecified
Then

{

If the Pending-preference-for-side of the super-power and Country is
not Unspecified

Then

{

Let the Preference-for-side of the super-power and the Country be
Pending-preference-for-side of the super-power and the Country.

Let the Pending-preference-for-side of the super-power and the
Country be Unspecified.

}

}

If the Preference-for-cooperation of the super-power and Country is
Unspecified

```
Then
{
  If the Pending-preference-for-cooperation of the super-power and
    the Country is not Unspecified
  Then
  {
    Let the Preference-for-cooperation of the super-power
      and the Country be the Pending-preference-for-cooperation
        of the super-power and the Country.
    Let the Pending-preference-for-cooperation of the super-power and
      the Country be Unspecified.
  }
}

If the Preference-for-SWAsian-involvement of the super-power and
  Country is Unspecified
Then
{
  If the Pending-preference-for-SWAsian-involvement of the super-power
    and Country is not Unspecified
  Then
  {
    Let the Preference-for-SWAsian-involvement of the super-power
      and the Country be Pending-preference-for-SWAsian-involvement
        of the super-power and the Country.
    Let the Pending-preference-for-SWAsian-involvement
      of the super-power and the Country be Unspecified.
  }
}

If the Preference-for-European-involvement of the super-power and Country
  is Unspecified
Then
{
  If the Pending-preference-for-European-involvement of the super-power
    and Country is not
      Unspecified
  Then
  {
    Let the Preference-for-European-involvement of the super-power
      and the Country be Pending-preference-for-European-involvement
        of the super-power and the Country.
    Let the Pending-preference-for-European-involvement
      of the super-power and the Country be Unspecified.
  }
}

}
}

End.

Define Determine-situation:
```

[Determine-situation uses variables set in various functions above to assign values to a variable called Situation, later to be used in the decision-making logic of the modeled countries.

]

If the Intercontinental-weapons-type of Red is greater than None
 or the Intercontinental-weapons-type of Blue is greater than None
 or the Intercontinental-weapons-type of White is greater than None
Then Let the Situation be Intercontinental-War.

Else If

(

 the European-weapons-type of Red is greater than None
 or the European-weapons-type of Blue is greater than None
 or the European-weapons-type of White is greater than None

)

and

(

 the SWAsian-weapons-type of Red is greater than None
 or the SWAsian-weapons-type of Blue is greater than None
 or the SWAsian-weapons-type of White is greater than None

)

Then Let the Situation be Multiple-Fronts.

Else If the European-weapons-type of Red is greater than None
 and the European-weapons-type of Blue is greater than None

Then Let the Situation be Theater-War.

Else If SWAsian-weapons-type of Red is greater than None
 and SWAsian-weapons-type of Blue is greater than None

Then Let the Situation be Theater-War.

Else Let the Situation be No-Conflict.

End.

Define Log-preamble:

[Log-preamble puts a header in the log-file, detailing certain elements of the world situation which will help establish a context for understanding the activities of Green Agent on a specific turn. Among the data recorded are locations of conflict, superpower weapons usage, and the game time.

]

Declare super-power by example: Let super-power be Type-country.

Declare count by example: Let count be 1.

Print Log-file with ".

Print Log-file with "The Present- time is: %d. Present-time.

If Lookahead is Yes

Then Log Log-file "*** Game mode is Lookahead ***".

Else Log Log-file "*** Game mode is Real ***".

Print Log-file with "The Situation is: %i. Situation.

```
For super-power [either] (US or USSR):
{
    Print Log-file with
        " %i SWAsian Involvement = %i European Involvement = %i
        (super-power) (SWAsian-involvement of super-power)
        ,European-involvement of super-power).
}

Let count be 0.
Print Log-file with "The conflict locations were:.
For every Actor:
{
    If Conflict-location-status of Actor is at least Conv
    Then
    {
        Print Log-file with "%i " Actor
        Increase count by 1.
        If count is at least 4
        Then
        {
            Let count be 0.
            Print Log-file with ".
        }
    }
}
Print Log-file.

Print Log-file with "The current weapon usage was:.
For Color:
{
    If the Intercontinental-weapons-type of Color is greater than None
    Then
        Print Log-file with "Intercontinental weapon use by %i was %i.
        Color (Intercontinental-weapons-type of Color).
    If the European-weapons-type of Color is greater than None
    or Color is not White
    Then
        Print Log-file with " European weapon use by %i was %i.
        Color (European-weapons-type of Color).
    If SWAsian-weapons-type of Color is greater than None
    or Color is not White
    Then
        Print Log-file with " SWAsian weapon use by %i was %i.
        Color SWAsian-weapons-type of Color).
}
Print Log-file with ".
Print Log-file.
```

End.

Define Decide-postures:

[Decide-postures uses several criteria to decide which countries get to move at any given time. It then invokes a function called Move to actually begin the decision-making cycles for those countries.

Declare request-check by example: Let request-check be Yes.

Declare regional-conflict-status by example:
Let regional-conflict-status be
Type-conflict-status.

Declare alliance-threat-status by example:
Let alliance-threat-status be Yes.

For every Actor:

{

 If the Player-status of the Actor is Yes

 Then

 {

 Let request-check be (the report from
 Check-for-superpower-requests using Actor as actor, and
 No as wakeup-flag).

 Let regional-conflict-status be
 (the Conflict-status of (the Region of the Actor)).

 Let alliance-threat-status be (the report from
 Check-for-threats-to-allies using (Membership of the Actor)
 as alliance).

 If request-check is Yes

 or regional-conflict-status is at least Conv

 or the European-involvement of the Actor is at least Combatant

 or the SWAsian-involvement of the Actor is at least Combatant

 or alliance-threat-status is Yes

 or USSR-border-mobilization-status of the Actor is Yes

 or US-border-mobilization-status of the Actor is Yes

 Then Perform Move.

 }

}

End.

Define Clear-preferences:

[Another utility function utilized at the end of a move to erase all
superpower requests which have been agreed to by the various actors.

For every Actor:

{

 Let USSR-preference-for-side of the Actor be Unspecified.

Let USSR-preference-for-cooperation of the Actor be Unspecified.
Let USSR-preference-for-SWAsian-involvement of the Actor be
Unspecified.
Let USSR-preference-for-European-involvement of the Actor be
Unspecified.

Let US-preference-for-side of the Actor be Unspecified.
Let US-preference-for-cooperation of the Actor be Unspecified.
Let US-preference-for-SWAsian-involvement of the Actor be
Unspecified.
Let US-preference-for-European-involvement of the Actor be
Unspecified.

}

End.

Define Do-ending-housekeeping:

[Ending-housekeeping closes the Green log-file.]

Perform Flush-stream Log-file.
Let Last-time be Monitor's Game-days.

End.

[This concludes the third section of Green Agent, the utility functions.]

[*****]

[Move begins the fourth and final part of Green Agent code which
contains the substantive rules used by the model to simulate the decision-
making behavior of various nations.

]

[*****]

Define Move:

[Move is the hub of substantive activity within Green Agent. It is
from this function that the model's primary decision-making making processes
are initiated and controlled.

]

Print Log-file with ".
Log Log-file "The Actor is:" Actor.

Perform Determine-alignment.

Let Previous-side of the Actor be (Side of the Actor).
Let Previous-cooperation of the Actor be (Cooperation of the Actor).
Let Previous-SWAsian-involvement of the Actor be
(SWAsian-involvement of the Actor).
Let Previous-European-involvement of the Actor be

(European-involvement of the Actor).

```
If      the Temperament of the Actor is Captive
      or the Temperament of the Actor is Satellite
Then Perform Determine-dependent-response.
Else
{
  Perform Assess-threat.
  If    the Threat of the Actor is less than Grave
      and the Threat of the Actor is not Unspecified
  Then
  {
    Perform Determine-automatic-response.
  }
  Else
  {
    Perform Assess-effectiveness.

    If    the Temperament of the Actor is Staunch
      or the Temperament of the Actor is Reliable
      or the Temperament of the Actor is Moderate
    Then Perform Determine-reliable-response.
    Else
    If    the Temperament of the Actor is Reluctant
      or the Temperament of the Actor is Soft
    Then Perform Determine-reluctant-response.
    Else
    If    the Temperament of the Actor is Neutral
    Then Perform Determine-neutral-response.
    Else
    If    the Temperament of the Actor is Initially-reluctant
    Then Perform Determine-initially-reluctant-response.
  }
}

Let All-done be Yes.

Perform Assess-promises.

Perform Check-for-conflict.

If the Assertive-status of the Actor is Yes
Then Perform Determine-assertive-response.

Perform Queue.

Perform Link.

Perform Send-messages-to-superpowers.

Print Log-file with ".
```

End.

Define Determine-alignment:

```
[ Determine-alignment contains rules which decide which superpower, if any,  
  a given actor is allied with.  
]
```

Declare region by example: Let the region be Type-area.

```
If           the Side of the Actor is Red  
Then Let the Ally of the Actor be USSR.  
Else If   the Side of the Actor is Blue  
Then Let the Ally of the Actor be US.  
Else If   the Side of the Actor is White  
Then  
{  
    If           the Orientation of the Actor is Red  
    Then Let the Ally of the Actor be USSR.  
    Else If   the Orientation of the Actor is Blue  
    Then Let the Ally of the Actor be US.  
    Else If   the Orientation of the Actor is White  
    Then Let the Ally of the Actor be Unspecified.  
    Else Log Log-file "ERROR:" Actor " has no Orientation specified."  
}  
Else  
{  
    Let the Ally of the Actor be Unspecified.  
}  
  
[ The following variables make programming easier by allowing the  
  transition from attribute value to entity possible resulting in cleaner,  
  more concise code  
]  
  
If           the Ally of the Actor is Unspecified  
Then  
{  
    Let the ally be Unspecified.  
    Let the Opponent be Unspecified..  
}  
Else If the Ally of the Actor is the US  
Then  
{  
    Let the ally be the US.  
    Let the Opponent be the USSR.  
}  
Else If the Ally of the Actor is the USSR  
Then  
{  
    Let the ally be the USSR.  
    Let the Opponent be the US.
```


}

End.

Define Assess-threat:

```
[ Assess-threat contains about four dozen rules, each describing a situation,
  or family of situations, which could arise in an RSAS game. Some rules
  apply to all countries (i.e., all actors perceive the same level of threat
  if they invaded) while others are used by some subset (countries in Europe
  will feel less threatened by a Soviet invasion of Iran than will Saudi
  Arabia, for example). Threat is one of the basic elements of the decision-
  making process of Green Agent.
]
```

Declare rule-test by example: Let rule-test be Yes.

Let the Threat of the Actor be Indeterminate.

[Indirectly-serious Threats]

```
If the Red-presence of South-Yemen is at least TripW
Then
{
  For Actor [either] ( Egypt or Sudan ):
    Let the Threat of the Actor be Indirectly-serious.
    Log Log-file "Indirectly-serious threat as"
      "Soviet presence increasing in South-Yemen.".
}
```

```
If the Red-presence of Libya is at least TripW
Then
{
  If the Actor is Israel
  Then
  {
    Let the Threat of the Actor be Indirectly-serious.
    Log Log-file "Indirectly-serious threat as"
      "Soviet presence increasing in Libya.".
  }
}
```

```
For [any] Country [who is a member of the] WP:
  If the Conflict-location-status of the Country is at least Conv
  and the Blue-presence of the Country is None
  and the European-weapons-type of Blue is None
  and the Red-presence of the Country is greater than None
  Then
  {
    If the Orientation of the Actor is not Red
```

```
        and the Region of the Actor is Europe
    Then
    {
        Let the Threat of the Actor be Indirectly-serious.
        Log Log-file "Indirectly-serious threat as"
            " Soviet invasion of a Warsaw-Pact member country."
    }
}

If the Region of the Actor is SWAsia
    and the Orientation of the Actor is Red
    and the European-involvement of the US is greater than Normal
Then
{
    Let the Threat of the Actor be Indirectly-serious.
    Log Log-file "Indirectly-serious threat as"
        " Blue mobilization in Europe."
}

If the USSR-border-mobilization-status of Iran is Yes
Then
{
    If (the Region of the Actor is Europe
        or the Actor is Canada
    )
        and the Orientation of the Actor is Blue
    Then
    {
        Let the Threat of the Actor be Indirectly-serious.
        Log Log-file "Indirectly-serious threat as Red active in SWAsia."
    }
}

If the USSR-border-mobilization-status of the FRG is Yes
Then
{
    If the Region of the Actor is SWAsia
        and the Orientation of the Actor is Blue
    Then
    {
        Let the Threat of the Actor be Indirectly-serious.
        Log Log-file "Indirectly-serious threat as"
            " Red mobilizing in Europe."
    }
}

If the Conflict-location-status of Yugoslavia is at least Conv
    and the Red-presence of Yugoslavia is greater than None
```

```
and the Blue-presence of Yugoslavia is           None
Then
{
  If the Region of the Actor is SWAsia
    and the Orientation of the Actor is Blue
  Then
  {
    Let the Threat of the Actor be Indirectly-serious.
    Log Log-file "Indirectly-serious threat as Red invasion of"
      "Yugoslavia.".
  }
}
```

```
If the Red-presence of South-Yemen is at least TripW
Then
{
  For Actor [either] ( North-Yemen or Oman or
    Saudi-Arabia
  ):
    Let the Threat of the Actor be Serious.
    Log Log-file "Serious threat as"
      "Soviet presence increasing in South-Yemen.".
}
```

```
If the Red-presence of Libya is at least TripW
Then
{
  For Actor [either] ( Egypt or Tunisia ):
    Let the Threat of the Actor be Serious.
    Log Log-file "Serious threat as"
      "Soviet presence increasing in Libya.".
}
```

```
If the Blue-presence of Israel is at least TripW
Then
{
  If the Actor is Syria
  Then
  {
    Let the Threat of the Actor be Serious.
    Log Log-file "Serious threat as"
      "introduction of US forces into Israel.".
  }
}
```

```
If the Red-presence of Ethiopia is at least TripW
Then
{
```

For Actor [either] (Saudi-Arabia or Somalia or Sudan):

Let the Threat of the Actor be Serious.

Log Log-file "Serious threat as"

" Soviet forces in Ethiopia."

}

If the Red-presence of Syria is at least TripW

Then

{

For Actor [either] (Iraq or Israel or Jordan or Lebanon or Turkey):

Let the Threat of the Actor be Serious.

Log Log-file "Serious threat as"

" introduction of Soviet forces into Syria."

}

If the Blue-presence of Egypt is at least TripW

and the Conflict-location-status of the Actor is at least Conv

and the Actor is Libya

Then

{

Let the Threat of the Actor be Serious.

Log Log-file "Serious threat as"

"US presence in Egypt."

}

If the European-involvement of the USSR is greater than Normal

Then

{

If

(

the Region of the Actor is Europe

or the Actor is Canada

or the Actor is Turkey

)

and the Orientation of the Actor is Blue

Then

{

Let the Threat of the Actor be Serious.

Log Log-file "Serious threat as Red mobilizing in Europe."

}

}

If SWAsian-involvement of the USSR is greater than Normal

and SWAsian-involvement of the USSR is less than Combatant

Then

{

```
If the Region of the Actor is SWAsia
and
(
    the      Orientation of the Actor is Blue
    or      the Orientation of the Actor is White
)
Then
{
    Let the Threat of the Actor be Serious.
    Log Log-file "Serious threat as"
    " Red mobilizing in Southwest Asia.".
}
}
```

```
If the USSR-border-mobilization-status of Iran is Yes
Then
{
    If the Region of the Actor is SWAsia
    and the Orientation of the Actor is not Red
    and the Membership of the Actor is not GCC
    Then
    {
        Let the Threat of the Actor be Serious.
        Log Log-file "Serious threat as pending Red invasion of Iran.".
    }
}
```

```
If the Region of the Actor is not SWAsia
and the Conflict-status of Europe is None
and the Conflict-status of SWAsia is at least Conv
and SWAsian-weapons-type of Blue is at least Conventional
and SWAsian-weapons-type of Red is at least Conventional
Then
{
    Let the Threat of the Actor be Serious.
    Log Log-file "Serious threat as Red/Blue combat"
    " outside of" Actor "'s region.".
}
}
```

```
If the Region of the Actor is not Europe
and the Conflict-status of SWAsia is None
and the Conflict-status of the Europe is at least Conv
and the European-weapons-type of Blue is at least Conventional
and the European-weapons-type of Red is at least Conventional
Then
{
    Let the Threat of the Actor be Serious.
    Log Log-file "Serious threat as Red/Blue combat"
    " outside of" Actor "'s region.".
}
}
```

[Indirectly-grave Threats]

```
If
(
  the      Membership of the Actor is NATO
  or the Membership of the Actor is WP
)
and the Conflict-status of Europe is less than Nuclear
and the Conflict-status of SWAsia is Nuclear
Then
{
  Let the Threat of the Actor be Indirectly-grave.
  Log Log-file "Indirectly-grave threat as"
    " nuclear weapons in use in Southwest Asia.".
}
```

```
If the USSR-border-mobilization-status of the FRG is Yes
Then
{
  If the Region of the Actor is Europe
    and the Orientation of the Actor is not Red
    and Membership of the Actor is not NATO
  Then
  {
    Let the Threat of the Actor be Indirectly-grave.
    Log Log-file "Indirectly-grave threat as Red threat to FRG.".
  }
}
```

```
If the Region of the Actor is SWAsia
and the Conflict-status of Europe is Nuclear
and the Conflict-status of SWAsia is less than Nuclear
Then
{
  Let the Threat of the Actor be Indirectly-grave.
  Log Log-file "Indirectly-grave threat as nuclear weapons in use"
    " outside of " Actor "'s region.".
}
```

```
If the Region of the Actor is Europe
and the Membership of the Actor is not WP
and the Membership of the Actor is not NATO
and the Conflict-status of Europe is less than Nuclear
and the Conflict-status of SWAsia is Nuclear
Then
{
  Let the Threat of the Actor be Indirectly-grave.
  Log Log-file "Indirectly-grave threat as nuclear weapons in use"
    " outside of " Actor "'s region.".
}
```

}

[Grave Threats]

If the USSR-border-mobilization-status of Iran is Yes

Then

{

If the Region of the Actor is SWAsia
and the Orientation of the Actor is not Red
and the Membership of the Actor is GCC

Then

{

Let the Threat of the Actor be Grave.
Log Log-file "Grave threat as pending Red attack north of Gulf."

}

}

If the Actor is Greece

Then

{

If the European-involvement of Turkey is greater than Normal
and the Conflict-status of Europe is less than Conv

Then

{

Let the Threat of Greece be Grave.
Log Log-file "Greece gravely threatened by Turkish mobilization."

}

}

If the USSR-border-mobilization-status of the FRG is Yes

Then

{

If the Membership of the Actor is NATO
and the Actor is not the FRG

Then

{

Let the Threat of the Actor be Grave.
Log Log-file "Grave threat as pending invasion of FRG."

}

}

If the Orientation of the Actor is not Red

Then

{

If the USSR-border-mobilization-status of the Actor is Yes

Then

{

Let the Threat of the Actor be Grave.
Log Log-file "Grave Threat as"
" Red mobilization against " Actor "."

}

}

If SWAsian-weapons-type of Blue is at least Conventional
and SWAsian-weapons-type of Red is at least Conventional
and the European-involvement of the USSR is greater than Normal
Then

{

 If the Membership of the Actor is NATO

 Then

 {

 Let the Threat of the Actor be Grave.

 Log Log-file "Grave Threat as Red/Blue combat"

 " in Southwest Asia and Red mobilization in Europe.".

 }

}

If the Conflict-location-status of the Actor is Conv
Then

{

 Let the Threat of the Actor be Grave.

 Log Log-file "Grave threat as" Actor

 "is a conflict location.".

}

If

(

 the Region of the Actor is Europe

 or the Actor is Canada

 or the Actor is Turkey

)

and the European-weapons-type of Blue is at least Conventional

and the European-weapons-type of Red is at least Conventional

Then

{

 Let the Threat of the Actor be Grave.

 Log Log-file "Grave threat as"

 " superpower combat in Europe.".

}

If the Region of the Actor is SWAsia
and SWAsian-weapons-type of Blue is at least Conventional
and SWAsian-weapons-type of Red is at least Conventional

Then

{

 Let the Threat of the Actor be Grave.

 Log Log-file "Grave threat as"

 " superpower combat in Southwest Asia.".

}


```
If the Conflict-location-status of the Actor is None
and the Membership of the Actor is NATO
Then
{
    Let rule-test be No.
    For [every] Country [that is a member of] NATO:
        If the Conflict-location-status of Country is at least Conv
        Then
        {
            Let rule-test be Yes.
            Let Attacked-ally be Country.
        }

    If rule-test is Yes
    Then
    {
        Let the Threat of the Actor be Grave.
        Log Log-file "Grave threat as"
            " attack against" Attacked-ally.
    }
}
```

```
If
(
    the Conflict-location-status of the US is Nuclear
    or the Conflict-location-status of the USSR is Nuclear
)
and the Membership of the Actor is not WP
and the Membership of the Actor is not NATO
and the Conflict-location-status of the Actor is None
Then
{
    Let the Threat of the Actor be Grave.
    Log Log-file "Grave threat as central nuclear exchange.".
}
}
```

```
If the Region of the Actor is Europe
or the Actor is Canada
or the Actor is Turkey
Then
{
    If the Conflict-status of Europe is Nuclear
    Then
    {
        Let the Threat of the Actor be Grave.
        Log Log-file "Grave threat as"
            " nuclear weapons in use in " Actor "'s region.".
    }
}
}
```

```
If the Region of the Actor is SWAsia
Then
{
  If the Conflict-status of SWAsia is Nuclear
  Then
  {
    Let the Threat of the Actor be Grave.
    Log Log-file "Grave threat as"
      " nuclear weapons in use in " Actor "'s region.".
  }
}
```

[Indirectly-mortal Threats]

```
If the Membership of the Actor is NATO
  and the Conflict-location-status of the US is Nuclear
Then
{
  Let the Threat of the Actor be Indirectly-mortal.
  Log Log-file "Indirectly-mortal threat as US under nuclear attack.".
}
```

```
If the Membership of the Actor is WP
  and the Conflict-location-status of the USSR is Nuclear
Then
{
  Let the Threat of the Actor be Indirectly-mortal.
  Log Log-file "Indirectly-mortal threat as USSR under nuclear attack.".
}
```

```
If
(
  the Cooperation of the Actor is at least Cobelligerent
  and
  (
    the European-involvement of the Actor is at least Combatant
    or
    the SWAsian-involvement of the Actor is at least Combatant
  )
  and the Conflict-location-status of the Actor is less than Nuclear
)
Then
{
  For every Color:
    If the European-weapons-type of Color is at least
      Battlefield-nuclear
    Then
    {
      Let the Threat of the Actor be Indirectly-mortal.
      Log Log-file "Indirectly-mortal threat as involvement in"
```

```
        " conflict where nuclear weapons are in use.".
    }
}

[Mortal]

    If the Red-presence of the Actor is not None
        and the Ally of the Actor is not the USSR
    Then
    {
        Let the Threat of the Actor be Mortal.
        Log Log-file "Mortal threat as Red invasion of" Actor ".".
    }

    If the Blue-presence of the Actor is not None
        and the Ally of the Actor is not the US
    Then
    {
        Let the Threat of the Actor be Mortal.
        Log Log-file "Mortal threat as Blue invasion of" Actor.
    }

    If the Conflict-location-status of the Actor is Nuclear
    Then
    {
        Let the Threat of the Actor be Mortal.
        Log Log-file "Mortal threat as nuclear weapons in use against" Actor.
    }

    If the Threat of the Actor is Indeterminate
    Then Log Log-file "Indeterminate-threat".

End.

Define Determine-automatic-response:

{ As outlined in Shlapak et. al., below a certain threshold of Threat,
  actors respond "automatically" to superpower requests. This function
  initiates this activity.
}

    If the Preference-for-side of the ally and the Actor
        is not Unspecified
        and the Side of the Actor is not (the Preference-for-side
            of the ally and the Actor)
    Then
    {
        Let the Side of the Actor be the Preference-for-side
```

```
    of the ally and the Actor.
    Log Log-file (Side of the Actor) "as ally preference.".
}

If the Temperament of the Actor is Staunch
Then
{
    If the Preference-for-cooperation of the ally and the Actor is
        at most Reinforcement
        and the Preference-for-cooperation of the ally and the Actor is
            not Unspecified
        and the Threat of the Actor is not Indirectly-grave
    Then
    {
        Let the Cooperation of the Actor be
            (the Preference-for-cooperation of the ally and the Actor).
        If the Previous-cooperation of the Actor is not the
            Cooperation of the Actor
        Then Log Log-file (Cooperation of the Actor)
            "due to ally request.".
    }
    Else If the Threat of the Actor is Indirectly-grave
        and the Preference-for-cooperation of the ally and the Actor is
            at most Cobelligerent
        and the Preference-for-cooperation of the ally and the Actor is
            not Unspecified
        and the Cooperation of the Actor is not
            (the Preference-for-cooperation of the ally and the Actor)
    Then
    {
        Let the Cooperation of the Actor be
            (the Preference-for-cooperation of the ally and the Actor).
        If the Previous-cooperation of the Actor is not the
            Cooperation of the Actor
        Then Log Log-file (Cooperation of the Actor)
            "due to ally request.".
    }
}

If the Threat of the Actor is Indirectly-serious
Then
{
    Let the SWAsian-involvement of the Actor be Normal.
    Let the European-involvement of the Actor be Normal.
    If the Previous-SWAsian-involvement of the Actor is not
        Normal
    Then Log Log-file " Normal involvement in SWAsia.".
    If the Previous-European-involvement of the Actor is not
        Normal
    Then Log Log-file " Normal involvement in Europe.".
}
```

If (the Region of the Actor is not SWAsia
or the Actor is Turkey

)

Then

{

Let the SWAsian-involvement of the Actor be Normal.

If the Previous-SWAsian-involvement of the Actor is not Normal

Then Log Log-file " Normal involvement in SWAsia.".

}

If the Region of the Actor is not Europe
and the Actor is not Turkey
and the Actor is not Canada

Then

{

Let the European-involvement of the Actor be Normal.

If the Previous-European-involvement of the Actor is not Normal

Then Log Log-file " Normal in Europe.".

}

If the Threat of the Actor is Serious

Then

{

If the Region of the Actor is SWAsia
and the Actor is not Turkey

Then

{

If the Preference-for-SWAsian-involvement of the ally and
the Actor is at most Low-alert
and the Preference-for-SWAsian-involvement of the ally and
the Actor is not Unspecified
and the SWAsian-involvement of the Actor is not
(the Preference-for-SWAsian-involvement of the ally and
the Actor)

Then

{

Let the SWAsian-involvement of the Actor be

(the Preference-for-SWAsian-involvement of the ally and
the Actor).

If the Previous-SWAsian-involvement of the Actor is not
the SWAsian-involvement of the Actor

Then Log Log-file (SWAsian-involvement of the Actor)
"due to ally request.".

}

Else If the Preference-for-SWAsian-involvement of the ally and
the Actor is greater than Low-alert
and the Preference-for-SWAsian-involvement of the ally and
the Actor is not Unspecified

Then

{

Let the SWAsian-involvement of the Actor be Low-alert.

If the SWAsian-involvement of the Actor is not Low-alert

```
        Then Log Log-file "Low-alert in SWAsia.".
    }
}
If the Region of the Actor is Europe
    or the Actor is Turkey
    or the Actor is Canada
Then
{
    If the Preference-for-European-involvement of the ally and
        the Actor is at most Low-alert
        and the Preference-for-European-involvement of the ally and
            the Actor is not Unspecified
        and the European-involvement of the Actor is not
            (the Preference-for-European-involvement of the ally and
                the Actor)
    Then
    {
        Let the European-involvement of the Actor be
            (the Preference-for-European-involvement of the ally and
                the Actor).
        If the Previous-European-involvement of the Actor
            is not the European-involvement of the Actor
        Then Log Log-file (European-involvement of the Actor)
            "due to ally request.".
    }
    Else If the Preference-for-European-involvement of the ally
        and the Actor is greater than Low-alert
        and the Preference-for-European-involvement of the ally and
            the Actor is not Unspecified
        and the European-involvement of the Actor is not
            (the Preference-for-European-involvement of the ally and
                the Actor)
    Then
    {
        Let the European-involvement of the Actor be Low-alert.
        If the Previous-European-involvement of the Actor
            is not Low-alert
        Then Log Log-file "Low-alert in Europe.".
    }
}
}
Else If the Threat of the Actor is Indirectly-grave
Then
{
    If the Region of the Actor is SWAsia
        and the Actor is not Turkey
    Then
    {
        If the Preference-for-SWAsian-involvement of the ally and
            the Actor is at most Full-alert
            and the Preference-for-SWAsian-involvement of the ally and
                the Actor is not Unspecified
```

and the SWAsian-involvement of the Actor is not
(the Preference-for-SWAsian-involvement of the ally and
the Actor)

Then

{

Let the SWAsian-involvement of the Actor be
(the Preference-for-SWAsian-involvement of the ally and
the Actor).

If the Previous-SWAsian-involvement of the Actor
is not SWAsian-involvement of the Actor

Then Log Log-file (SWAsian-involvement of the Actor)
"due to ally request."

}

Else If the Preference-for-SWAsian-involvement of the ally and
the Actor is greater than Full-alert

and the Preference-for-SWAsian-involvement of the ally and
the Actor is not Unspecified

and the SWAsian-involvement of the Actor is not
(the Preference-for-SWAsian-involvement of the ally and
the Actor)

Then

{

Let the SWAsian-involvement of the Actor be Full-alert.

If the Previous-SWAsian-involvement of the Actor
is not Low-alert

Then Log Log-file "Full-alert in SWAsia."

}

}

If the Region of the Actor is Europe

or the Actor is Turkey

or the Actor is Canada

Then

{

If the Preference-for-European-involvement of the ally and
the Actor is at most Full-alert

and the Preference-for-European-involvement of the ally and
the Actor is not Unspecified

and the European-involvement of the Actor is not
(the Preference-for-European-involvement of the ally and
the Actor)

Then

{

Let the European-involvement of the Actor be
(the Preference-for-European-involvement of the ally and
the Actor).

If the Previous-European-involvement of the Actor
is not the European-involvement of the Actor

Then Log Log-file (European-involvement of the Actor)
"due to ally request."

}

Else If the Preference-for-European-involvement of the ally

```
and the Actor is greater than Full-alert
and the Preference-for-European-involvement of the ally and
the Actor is not Unspecified
and the European-involvement of the Actor is not
(the Preference-for-European-involvement of the ally and
the Actor)
Then
{
  Let the European-involvement of the Actor be Full-alert.
  If the Previous-European-involvement of the Actor
  is not Full-alert
  Then Log Log-file "Full-alert in Europe.".
}
}
}
Else If the Temperament of the Actor is Reliable
Then
{
  If the Preference-for-cooperation of the ally and the Actor is
  at most Transit-base
  and the Preference-for-cooperation of the ally and the Actor is
  not Unspecified
  and the Threat of the Actor is Indirectly-serious
  and the Cooperation of the Actor is not
  (the Preference-for-cooperation of the ally and the Actor)
  Then
  {
    Let the Cooperation of the Actor be
    (the Preference-for-cooperation of the ally and the Actor).
    If the Previous-cooperation of the Actor is not
    the Cooperation of the Actor
    Then Log Log-file (Cooperation of the Actor)
    "due to ally request.".
  }
  Else If the Threat of the Actor is not Indirectly-serious
  and the Preference-for-cooperation of the ally and the Actor is
  at most Reinforcement
  and the Preference-for-cooperation of the ally and the Actor is
  not Unspecified
  and the Cooperation of the Actor is not
  (the Preference-for-cooperation of the ally and the Actor)
  Then
  {
    Let the Cooperation of the Actor be
    (the Preference-for-cooperation of the ally and the Actor).
    If the Previous-cooperation of the Actor is not
    the Cooperation of the Actor
    Then Log Log-file (Cooperation of the Actor)
    "due to ally request.".
  }
}
```


If the Threat of the Actor is indirectly-serious
or the Threat of the Actor is Serious

Then

```
{
    Let the SWAsian-involvement of the Actor be Normal.
    Let the European-involvement of the Actor be Normal.
    If the SWAsian-involvement of the Actor is not
        (the Previous-SWAsian-involvement of the Actor)
    Then Log Log-file " Normal involvement in SWAsia.".
    If the European-involvement of the Actor is not
        (the Previous-European-involvement of the Actor)
    Then Log Log-file " Normal involvement in Europe.".
}
```

If the Region of the Actor is not SWAsia
or the Actor is Turkey

Then

```
{
    Let the SWAsian-involvement of the Actor be Normal.
    If the Previous-SWAsian-involvement of the Actor is not Normal
    Then Log Log-file " Normal in SWAsia.".
}
```

If the Region of the Actor is not Europe
and the Actor is not Turkey
and the Actor is not Canada

Then

```
{
    Let the European-involvement of the Actor be Normal.
    If the Previous-European-involvement of the Actor is not Normal
    Then Log Log-file " Normal in Europe.".
}
```

If the Threat of the Actor is Indirectly-grave

Then

```
{
    If the Region of the Actor is SWAsia
        and the Actor is not Turkey
    Then
    {
        If the Preference-for-SWAsian-involvement of the ally and
            the Actor is at most Sustain-alert
            and the Preference-for-SWAsian-involvement of the ally and
                the Actor is not Unspecified
            and the SWAsian-involvement of the Actor is not
                (the Preference-for-SWAsian-involvement of the ally and
                    the Actor)
        Then
        {
            Let the SWAsian-involvement of the Actor be
                (the Preference-for-SWAsian-involvement of the ally and
                    the Actor).
        }
    }
}
```

```

    If the Previous-SWAsian-involvement of the Actor
      is not the SWAsian-involvement of the Actor
    Then Log Log-file (SWAsian-involvement of the Actor)
      "due to ally request."
  }
Else If the Preference-for-SWAsian-involvement of the ally and
  the Actor is greater than Sustain-alert
  and the Preference-for-SWAsian-involvement of the ally and
  the Actor is not Unspecified
  and the SWAsian-involvement of the Actor is not
    (the Preference-for-SWAsian-involvement of the ally and
    the Actor)
Then
{
  Let the SWAsian-involvement of the Actor be Sustain-alert.
  If the Previous-SWAsian-involvement of the Actor
    is not Sustain-alert
  Then Log Log-file "Sustain-alert in SWAsia."
}
}

If the Region of the Actor is Europe
  or the Actor is Turkey
  or the Actor is Canada
Then
{
  If the Preference-for-European-involvement of the ally and
    the Actor is at most Sustain-alert
    and the Preference-for-European-involvement of the ally and
    the Actor is not Unspecified
    and the European-involvement of the Actor is not
      (the Preference-for-European-involvement of the ally and
      the Actor)
  Then
  {
    Let the European-involvement of the Actor be
      (the Preference-for-European-involvement of the ally and
      the Actor).
    If the Previous-European-involvement of the Actor
      is not the European-involvement of the Actor
    Then Log Log-file (European-involvement of the Actor)
      "due to ally request."
  }
Else If the Preference-for-European-involvement of the ally
  and the Actor is greater than Sustain-alert
  and the Preference-for-European-involvement of the ally and
  the Actor is not Unspecified
  and the European-involvement of the Actor is not
    (the Preference-for-European-involvement of the ally and
    the Actor)
Then
{

```

```

        Let the European-involvement of the Actor be
        Sustain-alert.
        If the Previous-European-involvement of the Actor
        is not Sustain-alert
        Then Log Log-file "Sustain-alert in Europe.".
    }
}
}
Else If the Temperament of the Actor is Moderate
Then
{
    If the Preference-for-cooperation of the ally and the Actor is
    at most Transit-base
    and the Preference-for-cooperation of the ally and the Actor is
    not Unspecified
    and the Threat of the Actor is Serious
    and the Cooperation of the Actor is not
    (the Preference-for-cooperation of the ally and the Actor)
    Then
    {
        Let the Cooperation of the Actor be
        (the Preference-for-cooperation of the ally and the Actor).
        If the Previous-cooperation of the Actor is not
        the Cooperation of the Actor
        Then Log Log-file (Cooperation of the Actor)
        "due to ally request.".
    }
    Else If the Threat of the Actor is Indirectly-grave
    and the Preference-for-cooperation of the ally and the Actor is
    at most Reinforcement
    and the Preference-for-cooperation of the ally and the Actor is
    not Unspecified
    and the Cooperation of the Actor is not
    (the Preference-for-cooperation of the ally and the Actor)
    Then
    {
        Let the Cooperation of the Actor be
        (the Preference-for-cooperation of the ally and the Actor).
        If the Previous-cooperation of the Actor is not
        the Cooperation of the Actor
        Then Log Log-file (Cooperation of the Actor)
        "due to ally request.".
    }
}
If the Threat of the Actor is Indirectly-serious
or the Threat of the Actor is Serious
Then
{
    Let the SWAsian-involvement of the Actor be Normal.
    Let the European-involvement of the Actor be Normal.
    If the Previous-SWAsian-involvement of the Actor is not Normal

```

```
Then Log Log-file "Normal involvement in SWAsia.".
If the Previous-European-involvement of the Actor is not Normal
Then Log Log-file "Normal involvement in Europe.".
}
```

```
If the Region of the Actor is not SWAsia
or the Actor is Turkey
Then
{
  Let the SWAsian-involvement of the Actor be Normal.
  If the Previous-SWAsian-involvement of the Actor is not Normal
  Then Log Log-file "Normal involvement in SWAsia.".
}
```

```
If the Region of the Actor is not Europe
and the Actor is not Turkey
and the Actor is not Canada
Then
{
  Let the European-involvement of the Actor be Normal.
  If the Previous-European-involvement of the Actor is not Normal
  Then Log Log-file "Normal involvement in Europe.".
}
```

```
If the Threat of the Actor is Indirectly-grave
Then
{
```

```
  If the Region of the Actor is SWAsia
  and the Actor is not Turkey
  Then
  {
    If the Preference-for-SWAsian-involvement of the ally and
    the Actor is at most Low-alert
    and the Preference-for-SWAsian-involvement of the ally and
    the Actor is not Unspecified
    and the SWAsian-involvement of the Actor is not
    (the Preference-for-SWAsian-involvement of the ally and
    the Actor)
```

```
  Then
  {
    Let the SWAsian-involvement of the Actor be
    (the Preference-for-SWAsian-involvement of the ally and
    the Actor).
    If the Previous-SWAsian-involvement of the Actor
    is not the SWAsian-involvement of the Actor
    Then Log Log-file (SWAsian-involvement of the Actor)
    "due to ally request.".
  }
```

```
Else If the Preference-for-SWAsian-involvement of the ally and
the Actor is greater than Low-alert
and the Preference-for-SWAsian-involvement of the ally and
the Actor is not Unspecified
```

and the SWAsian-involvement of the Actor is not
(the Preference-for-SWAsian-involvement of the ally and
the Actor)

Then

{

Let the SWAsian-involvement of the Actor be Low-alert.
If the Previous-SWAsian-involvement of the Actor
is not Low-alert
Then Log Log-file "Low-alert in SWAsia."

}

}

If the Region of the Actor is Europe
or the Actor is Turkey
or the Actor is Canada

Then

{

If the Preference-for-European-involvement of the ally and
the Actor is at most Low-alert
and the Preference-for-European-involvement of the ally and
the Actor is not Unspecified
and the European-involvement of the Actor is not
(the Preference-for-European-involvement of the ally and
the Actor)

Then

{

Let the European-involvement of the Actor be
(the Preference-for-European-involvement of the ally and
the Actor).
If the Previous-European-involvement of the Actor
is not the European-involvement of the Actor
Then Log Log-file (European-involvement of the Actor)
"due to ally request."

}

Else If the Preference-for-European-involvement of the ally
and the Actor is greater than Low-alert
and the Preference-for-European-involvement of the ally and
the Actor is not Unspecified
and the European-involvement of the Actor is not
(the Preference-for-European-involvement of the ally and
the Actor)

Then

{

Let the European-involvement of the Actor be
Low-alert.
If the Previous-European-involvement of the Actor
is not Low-alert
Then Log Log-file "Low-alert in Europe."

}

}

}

}

```
Else If the Temperament of the Actor is Reluctant
Then
{
  If the Threat of the Actor is Indirectly-grave
  and the Preference-for-cooperation of the ally and the Actor
  is at most Transit-base
  and the Preference-for-cooperation of the ally and the Actor
  is not Unspecified
  and the Cooperation of the Actor is not
  (the Preference-for-cooperation of the ally and the Actor)
  Then
  {
    Let the Cooperation of the Actor be
    (the Preference-for-cooperation of the ally and the Actor).
    If the Previous-cooperation of the Actor is not
    the Cooperation of the Actor
    Then Log Log-file (Cooperation of the Actor)
    "due to ally request.".
  }
}

End.

Define Assess-effectiveness:

[ Above the Threat threshold for automatic response, Actors must first make
an assessment of the evolving world situation before deciding upon a
course of action. Assess-effectiveness is the function wherein this
analysis is carried out.
]

Declare sum by example:      Let the sum of the Actor be 1.0.
Declare ade-factor by example:
  Let the ade-factor of the Actor be 1.
Declare feba-factor by example:
  Let the feba-factor of the Actor be 1.

  Let the Effectiveness of the Actor be Medium.

  If the Region of the Actor is not Europe
  or the Conflict-status of Europe is None
  Then Exit.

  If the Military-strength of the Actor is Strong
  Then
  {
    If the ADE-ratio is at most 2
    Then Let ade-factor of the Actor be 3.
    Else If the ADE-ratio is greater than 4
    Then Let ade-factor of the Actor be 1.
    Else Let ade-factor of the Actor be 2.
  }
```

Else If the Military-strength of the Actor is Average
Then

{
 If the ADE-ratio is at most 2
 Then Let ade-factor of the Actor be 3.
 Else If the ADE-ratio is greater than 3
 Then Let ade-factor of the Actor be 1.
 Else Let ade-factor of the Actor be 2.
}

Else If the Military-strength of the Actor is Weak
Then

{
 If the ADE-ratio is at most 1
 Then Let ade-factor of the Actor be 3.
 Else If the ADE-ratio is greater than 2
 Then Let ade-factor of the Actor be 1.
 Else Let ade-factor of the Actor be 2.
}

If the FEBA-location is at most 25
Then Let feba-factor of the Actor be 3.
Else If the FEBA-location is at most 50
Then Let feba-factor of the Actor be 2.
Else Let feba-factor of the Actor be 1.

Let sum of the Actor be
 (ade-factor of the Actor + feba-factor of the Actor).

If sum of the Actor is at most 3.0
Then Let the Effectiveness of the Actor be Low.
Else If the sum of the Actor is at least 5.0
Then Let the Effectiveness of the Actor be High.

End.

Define Determine-dependent-response:

[This function is used to determine the behavior of Actors whose Temperaments
are either Captive or Satellite.
]

If the Ally of the Actor is Unspecified
Then
{
 Let All-done be No. [Prevent super power preference purge by Move]
 Log Log-file Actor " skipped."
 Log Log-file Actor " is a captive ally of an unspecified superpower."
 Exit.
}

If the Ally of the Actor is the US
Then

```
{
  Let All-done be No. [Prevent super power preference purge by Move]
  Log Log-file Actor " skipped..."
  Log Log-file Actor " is a captive ally of the US."
  Exit.
}
```

If the Ally of the Actor is the USSR

Then

```
{
  If the Preference-for-side of the ally and the Actor is not
    Unspecified
    and the Side of the Actor is not
      (the Preference-for-side of the ally and the Actor)
  Then
  {
    Let the Side of the Actor be the Preference-for-side of
      the ally and the Actor.
    Log Log-file (Side of Actor) "as ally request."
  }
}
```

```
If the Preference-for-cooperation of the ally and the Actor is not
  Unspecified
  and the Cooperation of the Actor is not
    (the Preference-for-cooperation of the ally and the Actor)
```

Then

```
{
  Let the Cooperation of the Actor be the Preference-for-cooperation
    of the ally and the Actor.
  Log Log-file (Cooperation of Actor) "as ally request."
}
```

```
If the Preference-for-SWAsian-involvement of the ally and the
  Actor is not Unspecified
  and the SWAsian-involvement of the Actor is not
    (the Preference-for-SWAsian-involvement of the ally and the
      Actor
    )
```

Then

```
{
  Let SWAsian-involvement of the Actor be the
    Preference-for-SWAsian-involvement of the ally and the
    Actor.
  Log Log-file (SWAsian-involvement of Actor)
    "as ally request."
}
```

```
If the Preference-for-European-involvement of the ally and the
  Actor is not Unspecified
  and the European-involvement of the Actor is not
    (the Preference-for-European-involvement of the ally and the
      Actor
```



```

    )
    Then
    {
        Let the European-involvement of the Actor be the
        Preference-for-European-involvement of the ally and the
        Actor.
        Log Log-file (European-involvement of Actor) "as ally request.".
    }
}

If (
    the Temperament of the Actor is Satellite
    and the Conflict-location-status of the USSR is Nuclear
    and the Red-presence of the Actor is less than Major
)
or
(
    the Temperament of the Actor is Captive
    and the Conflict-location-status of the Actor is Nuclear
    and the Conflict-location-status of the USSR is Nuclear
    and the Red-presence of the Actor is less than TripW
)
Then
{
    Let the Temperament of the Actor be Neutral.
    Let the Side of the Actor be White.
    Let the Cooperation of the Actor be Uncooperative.
    Let the SWAsian-involvement of the Actor be Disengaged.
    Let the European-involvement of the Actor be Disengaged.
    Log Log-file Actor " experiencing a civil revolt against Soviet "
    "domination.".
}

End.

Define Determine-initially-reluctant-response:

[ This function determines the behavior of Initially-reluctant entities. ]

    If the Threat of the Actor is less than Indirectly-grave
    Then
    {
        Let the Temperament of the Actor be Soft.
        Perform Determine-automatic-response.
    }
    Else
    {
        Let the Temperament of the Actor be Reliable.
        Perform Determine-reliable-response.
    }

End.

```

Define Determine-neutral-response:

[This function determines the actions of Neutral countries.]

If the Effectiveness of the Actor is not High
and the Conflict-location-status of the Actor is None

Then

{

Let the Side of the Actor be White.

Let the Cooperation of the Actor be Normal.

If the Region of the Actor is Europe

or the Actor is Canada

or the Actor is Turkey

Then

{

Let the European-involvement of the Actor be Low-alert.

Let SWAsian-involvement of the Actor be Normal.

}

Else If the Region of the Actor is SWAsia

Then

{

Let the European-involvement of the Actor be Normal.

Let the SWAsian-involvement of the Actor be Low-alert.

}

If the Previous-European-involvement of the Actor is

not the European-involvement of the Actor

or the Previous-SWAsian-involvement of the Actor is not

the SWAsian-involvement of the Actor

Then Log Log-file Actor "alerting forces due to threat."

}

Else If the Effectiveness of the Actor is High

Then

{

If the Threat of the Actor is Grave

or the Threat of the Actor is Indirectly-mortal

Then

{

Let the Side of the Actor be White.

Let the Cooperation of the Actor be Normal.

If the Region of the Actor is Europe

or the Actor is Canada

or the Actor is Turkey

Then

{

Let the European-involvement of the Actor be Full-alert.

Let SWAsian-involvement of the Actor be Normal.

}

Else If the Region of the Actor is SWAsia

Then

```
{
    Let the European-involvement of the Actor be Normal.
    Let the SWAsian-involvement of the Actor be Full-alert.
}

If the Previous-European-involvement of the Actor is
not the European-involvement of the Actor
or the Previous-SWAsian-involvement of the Actor is not
the SWAsian-involvement of the Actor
Then Log Log-file Actor
    "alerting and mobilizing forces due to threat.".
}
Else If the Threat of the Actor is Mortal
Then
{
    If the Conflict-location-status of the Actor is not Nuclear
    Then
    {
        If the Side of the Actor is not (the Side of the ally)
        Then Let the Side of the Actor be the Side of the ally.

        If the Cooperation of the Actor is less than Cobelligerent
        Then Let the Cooperation of the Actor be Cobelligerent.

        If the Region of the Actor is SWAsia
        and the SWAsian-involvement of the Actor is less than
        Combatant
        Then Let SWAsian-involvement of the Actor be
        Combatant.

        If the Region of the Actor is Europe
        or          the Actor is Canada
        or          the Actor is Turkey
        and the European-involvement of the Actor is less than
        Combatant
        Then Let the European-involvement of the Actor be Combatant.

        If the European-involvement of the Actor is greater than
        the (Previous-European-involvement of the Actor)
        or the SWAsian-involvement of the Actor is greater than
        the (Previous-SWAsian-involvement of the Actor)
        Then Log Log-file (Actor)
            "under attack; increasing involvement.".
    }
    Else
    {
        Let the Side of the Actor be White.
        Let the Cooperation of the Actor be Normal.
        Let the Preparedness of the Actor be Normal.
        Let SWAsian-involvement of the Actor be Normal.
        Let the European-involvement of the Actor be Normal.
        Log Log-file (Actor) "trying to limit damage.".
    }
}
```

```
    }  
  }  
}  
  
End.  
  
Define Determine-reliable-response:  
  
[ Determine-reliable-response defines the postures of Actors with Staunch,  
  Reliable, or Moderate Temperaments.  
]  
  
If the Preference-for-side of the ally and the Actor is not Unspecified  
  and the Side of the Actor is not (the Preference-for-side of the Actor  
    and the ally)  
Then  
{  
  Let the Side of the Actor be the Preference-for-side of the  
    ally and the Actor.  
  Log Log-file (Side of the Actor) "as ally request."  
}  
  
If the Temperament of the Actor is Staunch  
Then  
{  
  If the Preference-for-cooperation of the ally and the Actor is not  
    Unspecified  
    and the Cooperation of the Actor is not  
      (the Preference-for-cooperation of the ally and the Actor)  
  Then  
  {  
    Let the Cooperation of the Actor be the  
      Preference-for-cooperation of the ally and the Actor.  
    If the Previous-cooperation of the Actor is not  
      the Cooperation of the Actor  
    Then Log Log-file (Cooperation of the Actor) "as"  
      (Threat of the Actor) "threat and ally request."  
  }  
  Else  
  {  
    Let the Cooperation of the Actor be Nuc-releasor.  
    If the Previous-cooperation of the Actor is not Nuc-releasor  
    Then Log Log-file "Cobelligerent due to threat."  
  }  
  
  If the Preference-for-SWAsian-involvement of the ally and  
    the Actor is not Unspecified  
    and the SWAsian-involvement of the Actor is not  
      (the Preference-for-SWAsian-involvement of the ally and the Actor)  
  Then  
  {  
    Let SWAsian-involvement of the Actor be the
```

```

    Preference-for-SWAsian-involvement of the
    ally and the Actor.
    If the Previous-SWAsian-involvement of the Actor is not
    the SWAsian-involvement of the Actor
    Then Log Log-file (SWAsian-involvement of the Actor)
    "as" (Threat of the Actor) " threat and ally request.".
}
Else
{
    Let the SWAsian-involvement of the Actor be On-call.
    If the Previous-SWAsian-involvement of the Actor
    is less than On-call
    Then Log Log-file "On-call due to threat.".
}

If the Preference-for-European-involvement of the ally and
the Actor is not Unspecified
and the European-involvement of the Actor is not
(the Preference-for-European-involvement of the ally and the Actor)
Then
{
    If the Region of the Actor is Europe
    or          the Actor is Canada
    or          the Actor is Turkey
    Then
    {
        Let the European-involvement of the Actor be the
        Preference-for-European-involvement of the
        ally and the Actor.
        If the Previous-European-involvement of the Actor is not
        the European-involvement of the Actor
        Then Log Log-file (European-involvement of the Actor)
        "as" (Threat of the Actor) " threat and ally request.".
    }
}
Else
{
    If the Region of the Actor is Europe
    or          the Actor is Canada
    or          the Actor is Turkey
    Then
    {
        Let the European-involvement of the Actor be On-call.
        If the Previous-European-involvement of the Actor < On-call
        Then Log Log-file "On-call result of threat.".
    }
}
}
Else If the Temperament of the Actor is Reliable
Then
{
    If the Preference-for-cooperation of the ally and the Actor is
```

```

at most Cobelligerent
and the Preference-for-cooperation of the ally and the Actor is not
  Unspecified
and the Cooperation of the Actor is not
  (the Preference-for-cooperation of the ally and the Actor)
Then
{
  Let the Cooperation of the Actor be the (Preference-for-cooperation
    of the ally and the Actor).
  If the Cooperation of the Actor is not
    (the Previous-cooperation of the Actor)
  Then Log Log-file (Cooperation of Actor)
    "due to threat and ally request.".
}
Else
{
  Table
  {
    Declare threat by example:
      Let threat be Grave.
    Declare effect by example:
      Let effect be Type-effectiveness.
    Declare preference by example:
      Let preference be Type-cooperation.
    Declare cooperation by example:
      Let cooperation be Type-cooperation.

    If   threat      is (Threat of the Actor)
       and effect    is (Effectiveness of the Actor)
       and preference is (Preference-for-cooperation of the ally
         and the Actor)
    Then
    {
      Let the Cooperation of the Actor be cooperation.
      If the Cooperation of the Actor is not
        (the Previous-cooperation of the Actor)
      Then Log Log-file "Cooperation of" Actor "is now"
        cooperation"..".
    }
  }
}

```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>cooperation</u> |
|-------------------|---------------|-------------------|--------------------|
| Grave | Low | Unspecified | Cobelligerent |
| Grave | Low | Nuc-releasor | Cobelligerent |
| Grave | Medium | Unspecified | Cobelligerent |
| Grave | Medium | Nuc-releasor | Cobelligerent |
| Grave | High | Unspecified | Cobelligerent |
| Grave | High | Nuc-releasor | Cobelligerent |
| Indirectly-mortal | Low | Unspecified | Cobelligerent |
| Indirectly-mortal | Low | Nuc-releasor | Nuc-releasor |

| | | | |
|-------------------|--------|--------------|----------------|
| Indirectly-mortal | Medium | Unspecified | Cobelligerent |
| Indirectly-mortal | Medium | Nuc-releasor | Nuc-releasor |
| Indirectly-mortal | High | Unspecified | Cobelligerent |
| Indirectly-mortal | High | Nuc-releasor | Nuc-releasor |
| | | | |
| Mortal | Low | Unspecified | Cobelligerent |
| Mortal | Low | Nuc-releasor | Nuc-releasor |
| Mortal | Medium | Unspecified | Cobelligerent |
| Mortal | Medium | Nuc-releasor | Nuc-releasor |
| Mortal | High | Unspecified | Cobelligerent |
| Mortal | High | Nuc-releasor | Nuc-releasor . |

}

If the Region of the Actor is SWAsia
and the Actor is not Turkey

Then

{

 If the Preference-for-SWAsian-involvement of the ally and the Actor is
 at most Combatant
 and the Preference-for-SWAsian-involvement of the ally and the Actor
 is not Unspecified
 and the SWAsian-involvement of the Actor is not
 (the Preference-for-SWAsian-involvement of the ally and the Actor)

Then

{

 Let the SWAsian-involvement of the Actor be the
 (Preference-for-SWAsian-involvement of the ally and the Actor).
 If the Previous-SWAsian-involvement of the Actor is not
 the SWAsian-involvement of the Actor
 Then Log Log-file (SWAsian-involvement of Actor)
 "due to threat and ally request."

}

Else

{

 Table

{

 Declare threat by example:

 Let threat be Grave.

 Declare effect by example:

 Let effect be Type-effectiveness.

 Declare preference by example:

 Let preference be Type-involvement.

 Declare swa-inv by example:

 Let swa-inv be Type-involvement.

 If threat is (Threat of the Actor)

 and effect is (Effectiveness of the Actor)

 and preference is (Preference-for-SWAsian-involvement
 of the ally and the Actor)

Then

{

 Let the SWAsian-involvement of the Actor be swa-inv.

If the SWAsian-involvement of the Actor is not
 (the Previous-SWAsian-involvement of the Actor)
 Then Log Log-file "SWAsian-involvement of" Actor "is now"
 swa-inv".".

}
 }

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>swa-inv</u> |
|-------------------|---------------|-------------------|----------------|
| Grave | Low | Unspecified | On-call |
| Grave | Low | Nuc-combatant | Combatant |
| Grave | Medium | Unspecified | On-call |
| Grave | Medium | Nuc-combatant | Combatant |
| Grave | High | Unspecified | On-call |
| Grave | High | Nuc-combatant | Combatant |
| Indirectly-mortal | Low | Unspecified | On-call |
| Indirectly-mortal | Low | Nuc-combatant | Combatant |
| Indirectly-mortal | Medium | Unspecified | On-call |
| Indirectly-mortal | Medium | Nuc-combatant | Combatant |
| Indirectly-mortal | High | Unspecified | On-call |
| Indirectly-mortal | High | Nuc-combatant | Combatant |
| Mortal | Low | Unspecified | Combatant |
| Mortal | Low | Nuc-combatant | Combatant |
| Mortal | Medium | Unspecified | Combatant |
| Mortal | Medium | Nuc-combatant | Combatant |
| Mortal | High | Unspecified | Combatant |
| Mortal | High | Nuc-combatant | Combatant. |

}

}

Else If the Region of the Actor is not SWAsia
 or the Actor is Turkey

Then

{

Let the SWAsian-involvement of the Actor be Normal.

If the Previous-SWAsian-involvement of the Actor is not Normal

Then Log Log-file " Normal SWAsian involvement.".

}

If the Region of the Actor is Europe

or the Actor is Turkey

or the Actor is Canada

Then

{

If the Preference-for-European-involvement of the ally and the Actor
 is at most Combatant

and the Preference-for-European-involvement of the ally and the
 Actor is not Unspecified

and the European-involvement of the Actor is not

(the Preference-for-European-involvement of the ally and the Actor)


```

Then
{
  Let the European-involvement of the Actor be the
    (Preference-for-European-involvement of the ally and the Actor).
  If the Previous-European-involvement of the Actor is not
    the European-involvement of the Actor
  Then Log Log-file (European-involvement of Actor)
    "due to threat and ally request.".
}
Else
{
  Table
  {
    Declare threat by example:
      Let threat be Grave.
    Declare effect by example:
      Let effect be Type-effectiveness.
    Declare preference by example:
      Let preference be Type-involvement.
    Declare eur-inv by example:
      Let eur-inv be Type-involvement.

    If threat is (Threat of the Actor)
      and effect is (Effectiveness of the Actor)
      and preference is (Preference-for-European-involvement
        of the ally and the Actor)
    Then
    {
      Let the European-involvement of the Actor be eur-inv.
      If the European-involvement of the Actor is not
        (the Previous-European-involvement of the Actor)
      Then Log Log-file "European-involvement of" Actor
        "is now" eur-inv".
    }
  }
}

```

| threat | effect | preference | eur-inv |
|-------------------|--------|---------------|-----------|
| ===== | ===== | ===== | ===== |
| Grave | Low | Unspecified | On-call |
| Grave | Low | Nuc-combatant | Combatant |
| Grave | Medium | Unspecified | On-call |
| Grave | Medium | Nuc-combatant | Combatant |
| Grave | High | Unspecified | On-call |
| Grave | High | Nuc-combatant | Combatant |
| Indirectly-mortal | Low | Unspecifi | On-call |
| Indirectly-mortal | Low | Nuc-combatant | Combatant |
| Indirectly-mortal | Medium | Unspecified | On-call |
| Indirectly-mortal | Medium | Nuc-combatant | Combatant |
| Indirectly-mortal | High | Unspecified | On-call |

| | | | |
|-------------------|--------|---------------|-----------|
| Indirectly-mortal | High | Nuc-combatant | Combatant |
| Mortal | Low | Unspecified | Combatant |
| Mortal | Low | Nuc-combatant | Combatant |
| Mortal | Medium | Unspecified | Combatant |
| Mortal | Medium | Nuc-combatant | Combatant |
| Mortal | High | Unspecified | Combatant |
| Mortal | High | Nuc-combatant | Combatant |

```

    }
  }
Else If the Region of the Actor is not Europe
  and the Actor is not Turkey
  and the Actor is not Canada
Then
{
  Let the European-involvement of the Actor be Normal.
  If the Previous-European-involvement of the Actor is not Normal
  Then Log Log-file " Normal European involvement."
}
}
Else If the Temperament of the Actor is Moderate
Then
{
  If the Preference-for-cooperation of the ally and the Actor is not
  Unspecified
  Then
  {
    Table
    {
      Declare threat by example:
        Let threat be Grave.
      Declare effect by example:
        Let effect be Type-effectiveness.
      Declare preference by example:
        Let preference be Type-cooperation.
      Declare cooperation by example:
        Let cooperation be Type-cooperation.

      If threat is (Threat of the Actor)
      and effect is (Effectiveness of the Actor)
      and preference is (Preference-for-cooperation of the ally
      and the Actor)
      Then
      {
        Let the Cooperation of the Actor be cooperation.
        If the Cooperation of the Actor is not
        (the Previous-cooperation of the Actor)
        Then Log Log-file "Cooperation of" Actor "is now"
        cooperation.".
      }
    }
  }
}

```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>cooperation</u> |
|-------------------|---------------|-------------------|--------------------|
| Grave | Low | Transit-base | Transit-base |
| Grave | Low | Reinforcement | Reinforcement |
| Grave | Low | Cobelligerent | Reinforcement |
| Grave | Low | Nuc-releasor | Reinforcement |
| Grave | Medium | Transit-base | Transit-base |
| Grave | Medium | Reinforcement | Reinforcement |
| Grave | Medium | Cobelligerent | Cobelligerent |
| Grave | Medium | Nuc-releasor | Cobelligerent |
| Grave | High | Transit-base | Transit-base |
| Grave | High | Reinforcement | Reinforcement |
| Grave | High | Cobelligerent | Cobelligerent |
| Grave | High | Nuc-releasor | Cobelligerent |
| Indirectly-mortal | Low | Transit-base | Transit-base |
| Indirectly-mortal | Low | Reinforcement | Reinforcement |
| Indirectly-mortal | Low | Cobelligerent | Reinforcement |
| Indirectly-mortal | Low | Nuc-releasor | Reinforcement |
| Indirectly-mortal | Medium | Transit-base | Transit-base |
| Indirectly-mortal | Medium | Reinforcement | Reinforcement |
| Indirectly-mortal | Medium | Cobelligerent | Cobelligerent |
| Indirectly-mortal | Medium | Nuc-releasor | Cobelligerent |
| Indirectly-mortal | High | Transit-base | Transit-base |
| Indirectly-mortal | High | Reinforcement | Reinforcement |
| Indirectly-mortal | High | Cobelligerent | Cobelligerent |
| Indirectly-mortal | High | Nuc-releasor | Cobelligerent |
| Mortal | Low | Transit-base | Transit-base |
| Mortal | Low | Reinforcement | Reinforcement |
| Mortal | Low | Cobelligerent | Cobelligerent |
| Mortal | Low | Nuc-releasor | Nuc-releasor |
| Mortal | Medium | Transit-base | Transit-base |
| Mortal | Medium | Reinforcement | Reinforcement |
| Mortal | Medium | Cobelligerent | Cobelligerent |
| Mortal | Medium | Nuc-releasor | Nuc-releasor |
| Mortal | High | Transit-base | Transit-base |
| Mortal | High | Reinforcement | Reinforcement |
| Mortal | High | Cobelligerent | Cobelligerent |
| Mortal | High | Nuc-releasor | Cobelligerent |

If the Conflict-location-status of the Actor is Nuclear
and
(the Effectiveness of the Actor is High
or
the Effectiveness of the Actor is Medium
)
and the Preference-for-cooperation of the ally and the Actor
is Nuc-releasor
and the Cooperation of the Actor is not Nuc-releasor
Then

```

{
  Let the Cooperation of the Actor be Nuc-releasor.
  If the Previous-cooperation of the Actor is not
    Nuc-releasor
  Then Log Log-file
    "Nuclear release due to nuclear attack on" Actor.
}
}
Else
{
  Table
  {
    Declare threat by example:
      Let threat be Grave.
    Declare effect by example:
      Let effect be Type-effectiveness.
    Declare cooperation by example:
      Let cooperation be Type-cooperation.

    If   threat      is (Threat of the Actor)
       and effect    is (Effectiveness of the Actor)
    Then
    {
      Let the Cooperation of the Actor be cooperation.
      If the Cooperation of the Actor is not
        (the Previous-cooperation of the Actor)
      Then Log Log-file "Cooperation of" Actor "is now"
        cooperation".".
    }
  }
}

```

| threat | effect | cooperation |
|-------------------|--------|---------------|
| Grave | Low | Reinforcement |
| Grave | Medium | Cobelligerent |
| Grave | High | Cobelligerent |
| Indirectly-mortal | Low | Reinforcement |
| Indirectly-mortal | Medium | Cobelligerent |
| Indirectly-mortal | High | Cobelligerent |
| Mortal | Low | Nuc-releasor |
| Mortal | Medium | Nuc-releasor |
| Mortal | High | Cobelligerent |

```

}
If the Region of the Actor is SWAsia
  and the Actor is not Turkey
Then
{

```

Table

```
{
  Declare threat by example:
    Let threat be Grave.
  Declare effect by example:
    Let effect be Type-effectiveness.
  Declare preference by example:
    Let preference be Type-involvement.
  Declare swa-inv by example:
    Let swa-inv be Type-involvement.

  If   threat      is (Threat of the Actor)
    and effect      is (Effectiveness of the Actor)
    and preference  is (Preference-for-SWAsian-involvement
      of the ally and the Actor)
  Then
  {
    Let the SWAsian-involvement of the Actor be swa-inv.
    If the SWAsian-involvement of the Actor is not
      (the Previous-SWAsian-involvement of the Actor)
    Then Log Log-file "SWAsian-involvement of" Actor "is now"
      swa-inv".
  }
}
```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>swa-inv</u> |
|-------------------|---------------|-------------------|----------------|
| Grave | Low | Unspecified | Full-alert |
| Grave | Low | Low-alert | Low-alert |
| Grave | Low | Sustain-alert | Sustain-alert |
| Grave | Low | Full-alert | Full-alert |
| Grave | Low | On-call | Full-alert |
| Grave | Low | Combatant | Full-alert |
| Grave | Low | Nuc-combatant | Full-alert |
| Grave | Medium | Unspecified | On-call |
| Grave | Medium | Low-alert | On-call |
| Grave | Medium | Sustain-alert | On-call |
| Grave | Medium | Full-alert | On-call |
| Grave | Medium | On-call | On-call |
| Grave | Medium | Combatant | On-call |
| Grave | Medium | Nuc-combatant | On-call |
| Grave | High | Unspecified | On-call |
| Grave | High | Low-alert | Low-alert |
| Grave | High | Sustain-alert | Sustain-alert |
| Grave | High | Full-alert | Full-alert |
| Grave | High | On-call | On-call |
| Grave | High | Combatant | On-call |
| Grave | High | Nuc-combatant | On-call |
| Indirectly-mortal | Low | Unspecified | Full-alert |
| Indirectly-mortal | Low | Low-alert | Low-alert |

| | | | |
|-------------------|--------|---------------|---------------|
| Indirectly-mortal | Low | Sustain-alert | Sustain-alert |
| Indirectly-mortal | Low | Full-alert | Full-alert |
| Indirectly-mortal | Low | On-call | On-call |
| Indirectly-mortal | Low | Combatant | On-call |
| Indirectly-mortal | Low | Nuc-combatant | On-call |
| Indirectly-mortal | Medium | Unspecified | Full-alert |
| Indirectly-mortal | Medium | Low-alert | Low-alert |
| Indirectly-mortal | Medium | Sustain-alert | Sustain-alert |
| Indirectly-mortal | Medium | Full-alert | Full-alert |
| Indirectly-mortal | Medium | On-call | On-call |
| Indirectly-mortal | Medium | Combatant | On-call |
| Indirectly-mortal | Medium | Nuc-combatant | On-call |
| Indirectly-mortal | High | Unspecified | On-call |
| Indirectly-mortal | High | Low-alert | Low-alert |
| Indirectly-mortal | High | Sustain-alert | Sustain-alert |
| Indirectly-mortal | High | Full-alert | Full-alert |
| Indirectly-mortal | High | On-call | On-call |
| Indirectly-mortal | High | Combatant | On-call |
| Indirectly-mortal | High | Nuc-combatant | On-call |
| Mortal | -- | -- | Combatant. |

```

If the Conflict-location-status of the Actor is Nuclear
and (
    the Effectiveness of the Actor is High
    or
    the Effectiveness of the Actor is Medium
)
and the Preference-for-SWAsian-involvement of the ally and
the Actor is Nuc-combatant
Then
{
    Let the SWAsian-involvement of the Actor be Nuc-combatant.
    If the Previous-SWAsian-involvement of the Actor is not
    Nuc-combatant
    Then Log Log-file "Nuclear-combat due to nuclear attack.".
}
}
Else If the Region of the Actor is not SWAsia
or the Actor is Turkey
Then
{
    Let the SWAsian-involvement of the Actor be Normal.
    If the Previous-SWAsian-involvement of the Actor is not Normal
    Then Log Log-file " Normal SWAsian involvement.".
}
}

If the Region of the Actor is Europe
or the Actor is Turkey
or the Actor is Canada
Then
{

```

Table

```
{
  Declare threat by example:
    Let threat be Grave.
  Declare effect by example:
    Let effect be Type-effectiveness.
  Declare preference by example:
    Let preference be Type-involvement.
  Declare eur-inv by example:
    Let eur-inv be Type-involvement.

  If   threat      is (Threat of the Actor)
    and effect     is (Effectiveness of the Actor)
    and preference is (Preference-for-European-involvement
      of the ally and the Actor)
  Then
  {
    Let the European-involvement of the Actor be eur-inv.
    If the European-involvement of the Actor is not
      (the Previous-European-involvement of the Actor)
    Then Log Log-file "European-involvement of" Actor "is now"
      eur-inv".
  }
}
```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>eur-inv</u> |
|-------------------|---------------|-------------------|----------------|
| Grave | Low | Unspecified | Full-alert |
| Grave | Low | Low-alert | Low-alert |
| Grave | Low | Sustain-alert | Sustain-alert |
| Grave | Low | Full-alert | Full-alert |
| Grave | Low | On-call | Full-alert |
| Grave | Low | Combatant | Full-alert |
| Grave | Low | Nuc-combatant | Full-alert |
| Grave | Medium | Unspecified | On-call |
| Grave | Medium | Low-alert | On-call |
| Grave | Medium | Sustain-alert | On-call |
| Grave | Medium | Full-alert | On-call |
| Grave | Medium | On-call | On-call |
| Grave | Medium | Combatant | On-call |
| Grave | Medium | Nuc-combatant | On-call |
| Grave | High | Unspecified | On-call |
| Grave | High | Low-alert | Low-alert |
| Grave | High | Sustain-alert | Sustain-alert |
| Grave | High | Full-alert | Full-alert |
| Grave | High | On-call | On-call |
| Grave | High | Combatant | On-call |
| Grave | High | Nuc-combatant | On-call |
| Indirectly-mortal | Low | Unspecified | Full-alert |
| Indirectly-mortal | Low | Low-alert | Low-alert |

| | | | |
|-------------------|--------|---------------|---------------|
| Indirectly-mortal | Low | Sustain-alert | Sustain-alert |
| Indirectly-mortal | Low | Full-alert | Full-alert |
| Indirectly-mortal | Low | On-call | On-call |
| Indirectly-mortal | Low | Combatant | On-call |
| Indirectly-mortal | Low | Nuc-combatant | On-call |
| Indirectly-mortal | Medium | Unspecified | Full-alert |
| Indirectly-mortal | Medium | Low-alert | Low-alert |
| Indirectly-mortal | Medium | Sustain-alert | Sustain-alert |
| Indirectly-mortal | Medium | Full-alert | Full-alert |
| Indirectly-mortal | Medium | On-call | On-call |
| Indirectly-mortal | Medium | Combatant | On-call |
| Indirectly-mortal | Medium | Nuc-combatant | On-call |
| Indirectly-mortal | High | Unspecified | On-call |
| Indirectly-mortal | High | Low-alert | Low-alert |
| Indirectly-mortal | High | Sustain-alert | Sustain-alert |
| Indirectly-mortal | High | Full-alert | Full-alert |
| Indirectly-mortal | High | On-call | On-call |
| Indirectly-mortal | High | Combatant | On-call |
| Indirectly-mortal | High | Nuc-combatant | On-call |
| Mortal | -- | -- | Combatant. |

```

If the Conflict-location-status of the Actor is Nuclear
and (
    the Effectiveness of the Actor is High
    or
    the Effectiveness of the Actor is Medium
)
and the Preference-for-European-involvement of the ally and
the Actor is Nuc-combatant
Then
{
    Let the European-involvement of the Actor be Nuc-combatant.
    If the Previous-European-involvement of the Actor is not
    Nuc-combatant
    Then Log Log-file "Nuclear-combat due to nuclear attack.".
}
}
Else If the Region of the Actor is not Europe
and the Actor is not Turkey
and the Actor is not Canada
Then
{
    Let the European-involvement of the Actor be Normal.
    If the Previous-European-involvement of the Actor is not Normal
    Then Log Log-file " Normal European involvement.".
}
}
End.

```

Define Determine-reluctant-response:


```
[ This function is used to determine the behavior of Reluctant and Soft
  Actors.
]
```

```
If the Preference-for-side of the ally and the Actor is not Unspecified
  and the Side of the Actor is not
  (the Preference-for-side of the ally and the Actor)
```

```
Then
```

```
{
  Let the Side of the Actor be the Preference-for-side of the
    ally and the Actor.
  If the Previous-side of the Actor is not the Side of the Actor
  Then Log Log-file (Side of the Actor) "as ally request.".
}
```

```
If the Temperament of the Actor is Reluctant
```

```
Then
```

```
{
```

```
  Table
```

```
  {
```

```
    Declare threat by example:
```

```
      Let threat be Grave.
```

```
    Declare effect by example:
```

```
      Let effect be Type-effectiveness.
```

```
    Declare preference by example:
```

```
      Let preference be Type-cooperation.
```

```
    Declare cooperation by example:
```

```
      Let cooperation be Type-cooperation.
```

```
  If      threat      is (Threat of the Actor)
```

```
    and effect      is (Effectiveness of the Actor)
```

```
    and preference  is (Preference-for-cooperation of the ally
      and the Actor)
```

```
  Then
```

```
  {
```

```
    Let the Cooperation of the Actor be cooperation.
```

```
    If the European-involvement of the Actor is not
```

```
      (the Previous-European-involvement of the Actor)
```

```
    Then Log Log-file "Cooperation of" Actor "is now" cooperation".".
```

```
  }
```

```
}
```

| threat | effect | preference | cooperation |
|--------|--------|---------------|--------------|
| ===== | ===== | ===== | ===== |
| Grave | Low | Unspecified | Normal |
| Grave | Low | Transit-base | Normal |
| Grave | Low | Reinforcement | Normal |
| Grave | Low | Cobelligerent | Normal |
| Grave | Low | Nuc-releasor | Normal |
| Grave | Medium | Unspecified | Normal |
| Grave | Medium | Transit-base | Transit-base |

| | | | |
|-------|--------|---------------|---------------|
| Grave | Medium | Reinforcement | Transit-base |
| Grave | Medium | Cobelligerent | Transit-base |
| Grave | Medium | Nuc-releasor | Transit-base |
| Grave | High | Unspecified | Normal |
| Grave | High | Transit-base | Transit-base |
| Grave | High | Reinforcement | Reinforcement |
| Grave | High | Cobelligerent | Reinforcement |
| Grave | High | Nuc-releasor | Reinforcement |

| | | | |
|-------------------|--------|---------------|---------------|
| Indirectly-mortal | Low | Unspecified | Uncooperative |
| Indirectly-mortal | Low | Transit-base | Uncooperative |
| Indirectly-mortal | Low | Reinforcement | Uncooperative |
| Indirectly-mortal | Low | Cobelligerent | Uncooperative |
| Indirectly-mortal | Low | Nuc-releasor | Uncooperative |
| Indirectly-mortal | Medium | Unspecified | Normal |
| Indirectly-mortal | Medium | Transit-base | Transit-base |
| Indirectly-mortal | Medium | Reinforcement | Reinforcement |
| Indirectly-mortal | Medium | Cobelligerent | Reinforcement |
| Indirectly-mortal | Medium | Nuc-releasor | Reinforcement |
| Indirectly-mortal | High | Unspecified | Normal |
| Indirectly-mortal | High | Transit-base | Transit-base |
| Indirectly-mortal | High | Reinforcement | Reinforcement |
| Indirectly-mortal | High | Cobelligerent | Cobelligerent |
| Indirectly-mortal | High | Nuc-releasor | Cobelligerent |

| | | | |
|--------|--------|---------------|----------------|
| Mortal | Low | Unspecified | Uncooperative |
| Mortal | Low | Transit-base | Uncooperative |
| Mortal | Low | Reinforcement | Uncooperative |
| Mortal | Low | Cobelligerent | Uncooperative |
| Mortal | Low | Nuc-releasor | Uncooperative |
| Mortal | Medium | -- | Cobelligerent |
| Mortal | High | -- | Cobelligerent. |

If the Conflict-location-status of the Actor is Nuclear
and

(the Effectiveness of the Actor is High
or
the Effectiveness of the Actor is Medium
)

and the Preference-for-cooperation of the ally and the Actor
is Nuc-releasor

Then

```
{
    Let the Cooperation of the Actor be Nuc-releasor.
    If the Previous-cooperation of the Actor is not Nuc-releasor
    Then Log Log-file "Nuclear release due to nuclear attack on" Actor.
}
```

If the Region of the Actor is SWAsia
and the Actor is not Turkey

Then

```
{
```

Table

```
{
  Declare threat by example:
    Let threat be Grave.
  Declare effect by example:
    Let effect be Type-effectiveness.
  Declare preference by example:
    Let preference be Type-involvement.
  Declare swa-inv by example:
    Let swa-inv be Type-involvement.

  If   threat      is (Threat of the Actor)
    and effect      is (Effectiveness of the Actor)
    and preference  is (Preference-for-SWAsian-involvement
      of the ally and the Actor)
  Then
  {
    Let the SWAsian-involvement of the Actor be swa-inv.
    If the SWAsian-involvement of the Actor is not
      (the Previous-SWAsian-involvement of the Actor)
    Then Log Log-file "SWAsian-involvement of" Actor "is now"
      swa-inv".
  }
}
```

| threat | effect | preference | swa-inv |
|-------------------|--------|---------------|------------|
| Grave | Low | Unspecified | Low-alert |
| Grave | Low | Low-alert | Low-alert |
| Grave | Low | Sustain-alert | Low-alert |
| Grave | Low | Full-alert | Low-alert |
| Grave | Low | On-call | Low-alert |
| Grave | Low | Combatant | Low-alert |
| Grave | Low | Nuc-combatant | Low-alert |
| Grave | Medium | Unspecified | Low-alert |
| Grave | Medium | Low-alert | Low-alert |
| Grave | Medium | Sustain-alert | Low-alert |
| Grave | Medium | Full-alert | Low-alert |
| Grave | Medium | On-call | Low-alert |
| Grave | Medium | Combatant | Low-alert |
| Grave | Medium | Nuc-combatant | Full-alert |
| Grave | High | Unspecified | Full-alert |
| Grave | High | Low-alert | Full-alert |
| Grave | High | Sustain-alert | Full-alert |
| Grave | High | Full-alert | Full-alert |
| Grave | High | On-call | Full-alert |
| Grave | High | Combatant | Full-alert |
| Grave | High | Nuc-combatant | Full-alert |
| Indirectly-mortal | Low | -- | Disengaged |
| Indirectly-mortal | Medium | Unspecified | Normal |

| | | | |
|-------------------|--------|---------------|------------|
| Indirectly-mortal | Medium | Low-alert | Full-alert |
| Indirectly-mortal | Medium | Sustain-alert | Full-alert |
| Indirectly-mortal | Medium | Full-alert | Full-alert |
| Indirectly-mortal | Medium | On-call | Full-alert |
| Indirectly-mortal | Medium | Combatant | Full-alert |
| Indirectly-mortal | Medium | Nuc-combatant | Full-alert |
| Indirectly-mortal | High | -- | On-call |
| | | | |
| Mortal | Low | Unspecified | Disengaged |
| Mortal | Low | Low-alert | Disengaged |
| Mortal | Low | Sustain-alert | Disengaged |
| Mortal | Low | Full-alert | Disengaged |
| Mortal | Low | On-call | Disengaged |
| Mortal | Low | Combatant | Disengaged |
| Mortal | Low | Nuc-combatant | Disengaged |
| Mortal | Medium | -- | Combatant |
| Mortal | High | -- | Combatant. |

```

If the Conflict-location-status of the Actor is Nuclear
and
  ( the Effectiveness of the Actor is High
    or
    the Effectiveness of the Actor is Medium
  )
and the Preference-for-SWAsian-involvement of the ally and the Actor
is Nuc-combatant

```

```

Then
{
  Let the SWAsian-involvement of the Actor be Nuc-combatant.
  If the Previous-SWAsian-involvement of the Actor is not
    Nuc-combatant
  Then Log Log-file "Nuclear combat due to nuclear attack on" Actor.
}

```

```

}
Else If the Region of the Actor is not SWAsia
or the Actor is Turkey
Then
{
  Let the SWAsian-involvement of the Actor be Normal.
  If the Previous-SWAsian-involvement of the Actor is not Normal
  Then Log Log-file "Normal SWAsian involvement.".
}

```

```

If the Region of the Actor is Europe
or the Actor is Turkey
or the Actor is Canada
Then
{
  Table
  {
    Declare threat by example:
    Let threat be Grave.
  }
}

```

Declare effect by example:

Let effect be Type-effectiveness.

Declare preference by example:

Let preference be Type-involvement.

Declare eur-inv by example:

Let eur-inv be Type-involvement.

```

If   threat      is (Threat of the Actor)
and effect      is (Effectiveness of the Actor)
and preference  is (Preference-for-European-involvement
of the ally and the Actor)
Then
{
  Let the European-involvement of the Actor be eur-inv.
  If the European-involvement of the Actor is not
  (the Previous-European-involvement of the Actor)
  Then Log Log-file "European-involvement of" Actor "is now"
  eur-inv".
}
}

```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>eur-inv</u> |
|-------------------|---------------|-------------------|----------------|
| Grave | Low | Unspecified | Low-alert |
| Grave | Low | Low-alert | Low-alert |
| Grave | Low | Sustain-alert | Low-alert |
| Grave | Low | Full-alert | Low-alert |
| Grave | Low | On-call | Low-alert |
| Grave | Low | Combatant | Low-alert |
| Grave | Low | Nuc-combatant | Low-alert |
| Grave | Medium | Unspecified | Low-alert |
| Grave | Medium | Low-alert | Low-alert |
| Grave | Medium | Sustain-alert | Low-alert |
| Grave | Medium | Full-alert | Low-alert |
| Grave | Medium | On-call | Low-alert |
| Grave | Medium | Combatant | Low-alert |
| Grave | Medium | Nuc-combatant | Full-alert |
| Grave | High | Unspecified | Full-alert |
| Grave | High | Low-alert | Full-alert |
| Grave | High | Sustain-alert | Full-alert |
| Grave | High | Full-alert | Full-alert |
| Grave | High | On-call | Full-alert |
| Grave | High | Combatant | Full-alert |
| Grave | High | Nuc-combatant | Full-alert |
| Indirectly-mortal | Low | -- | Disengaged |
| Indirectly-mortal | Medium | Unspecified | Normal |
| Indirectly-mortal | Medium | Low-alert | Full-alert |
| Indirectly-mortal | Medium | Sustain-alert | Full-alert |
| Indirectly-mortal | Medium | Full-alert | Full-alert |
| Indirectly-mortal | Medium | On-call | Full-alert |

| | | | |
|-------------------|--------|---------------|------------|
| Indirectly-mortal | Medium | Combatant | Full-alert |
| Indirectly-mortal | Medium | Nuc-combatant | Full-alert |
| Indirectly-mortal | High | -- | On-call |
| Mortal | Low | Unspecified | Disengaged |
| Mortal | Low | Low-alert | Disengaged |
| Mortal | Low | Sustain-alert | Disengaged |
| Mortal | Low | Full-alert | Disengaged |
| Mortal | Low | On-call | Disengaged |
| Mortal | Low | Combatant | Disengaged |
| Mortal | Low | Nuc-combatant | Disengaged |
| Mortal | Medium | -- | Combatant |
| Mortal | High | -- | Combatant. |

If the Conflict-location-status of the Actor is Nuclear
and
(the Effectiveness of the Actor is High
or
the Effectiveness of the Actor is Medium
)
and the Preference-for-European-involvement of the ally and the Actor
is Nuc-combatant

Then
{
Let the European-involvement of the Actor be Nuc-combatant.
If the Previous-European-involvement of the Actor is not
Nuc-combatant
Then Log Log-file "Nuclear combat due to nuclear attack on" Actor.
}
}

Else If the Region of the Actor is not Europe
and the Actor is not Turkey
and the Actor is not Canada

Then
{
Let the European-involvement of the Actor be Normal.
If the Previous-European-involvement of the Actor is not Normal
Then Log Log-file " Normal European involvement."
}
}

Else If the Temperament of the Actor is Soft

Then

{
Table

{
Declare threat by example:
Let threat be Grave.
Declare effect by example:
Let effect be Type-effectiveness.
Declare preference by example:
Let preference be Type-cooperation.
Declare cooperation by example:

Let cooperation be Type-cooperation.

```

If   threat      is (Threat of the Actor)
   and effect    is (Effectiveness of the Actor)
   and preference is (Preference-for-cooperation of the ally
                     and the Actor)
Then
{
  Let the Cooperation of the Actor be cooperation.
  If the Cooperation of the Actor is not
    (the Previous-cooperation of the Actor)
    Then Log Log-file "Cooperation of" Actor "is now" cooperation.".
}
}

```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>cooperation</u> |
|-------------------|---------------|-------------------|--------------------|
| Grave | Low | Unspecified | Normal |
| Grave | Low | Transit-base | Normal |
| Grave | Low | Reinforcement | Normal |
| Grave | Low | Cobelligerent | Normal |
| Grave | Low | Nuc-releasor | Normal |
| Grave | Medium | Unspecified | Normal |
| Grave | Medium | Transit-base | Normal |
| Grave | Medium | Reinforcement | Normal |
| Grave | Medium | Cobelligerent | Normal |
| Grave | Medium | Nuc-releasor | Normal |
| Grave | High | Unspecified | Normal |
| Grave | High | Transit-base | Transit-base |
| Grave | High | Reinforcement | Transit-base |
| Grave | High | Cobelligerent | Transit-base |
| Grave | High | Nuc-releasor | Transit-base |
| Indirectly-mortal | Low | Unspecified | Normal |
| Indirectly-mortal | Low | Transit-base | Normal |
| Indirectly-mortal | Low | Reinforcement | Normal |
| Indirectly-mortal | Low | Cobelligerent | Normal |
| Indirectly-mortal | Low | Nuc-releasor | Normal |
| Indirectly-mortal | Medium | Unspecified | Normal |
| Indirectly-mortal | Medium | Transit-base | Normal |
| Indirectly-mortal | Medium | Reinforcement | Normal |
| Indirectly-mortal | Medium | Cobelligerent | Normal |
| Indirectly-mortal | Medium | Nuc-releasor | Normal |
| Indirectly-mortal | High | Unspecified | Reinforcement |
| Indirectly-mortal | High | Transit-base | Reinforcement |
| Indirectly-mortal | High | Reinforcement | Reinforcement |
| Indirectly-mortal | High | Cobelligerent | Reinforcement |
| Indirectly-mortal | High | Nuc-releasor | Reinforcement |
| Mortal | Low | -- | Uncooperative |
| Mortal | Medium | -- | Uncooperative |

Mortal High -- Cobelligerent.

If the Conflict-location-status of the Actor is Nuclear
and the Effectiveness of the Actor is Low

Then

```
{
  Let the Cooperation of the Actor be Uncooperative.
  If the Cooperation of the Actor is not
    (the Previous-cooperation of the Actor)
  Then Log Log-file "Nuclear attack compels disengagement.".
}
```

If the Region of the Actor is SWAsia
and the Actor is not Turkey

Then

```
{
  Table
  {
    Declare threat by example:
      Let threat be Grave.
    Declare effect by example:
      Let effect be Type-effectiveness.
    Declare preference by example:
      Let preference be Type-involvement.
    Declare swa-inv by example:
      Let swa-inv be Type-involvement.

    If   threat      is (Threat of the Actor)
      and effect     is (Effectiveness of the Actor)
      and preference is (Preference-for-SWAsian-involvement
        of the ally and the Actor)
    Then
    {
      Let the SWAsian-involvement of the Actor be swa-inv.
      If the SWAsian-involvement of the Actor is not
        (the Previous-SWAsian-involvement of the Actor)
      Then Log Log-file "SWAsian-involvement of" Actor "is now"
        swa-inv".
    }
  }
}
```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>swa-inv</u> |
|-------------------|---------------|-------------------|----------------|
| Grave | -- | -- | Normal |
| Indirectly-mortal | Low | -- | Normal |
| Indirectly-mortal | Medium | -- | Normal |
| Indirectly-mortal | High | -- | On-call |
| Mortal | Low | -- | Disengaged |
| Mortal | Medium | -- | Disengaged |


```

        Mortal           High    --           Combatant.
    }
Else If the Region of the Actor is not SWAsia
    or the Actor is Turkey
Then
{
    Let the SWAsian-involvement of the Actor be Normal.
    If the Previous-SWAsian-involvement of the Actor is not Normal
    Then Log Log-file " Normal SWAsian involvement.".
}

If the Region of the Actor is Europe
    or the Actor is Turkey
    or the Actor is Canada
Then
{
    Table
    {
        Declare threat by example:
        Let threat be Grave.
        Declare effect by example:
        Let effect be Type-effectiveness.
        Declare preference by example:
        Let preference be Type-involvement.
        Declare eur-inv by example:
        Let eur-inv be Type-involvement.

        If   threat      is (Threat of the Actor)
        and effect      is (Effectiveness of the Actor)
        and preference  is (Preference-for-European-involvement
                           of the ally and the Actor)
        Then
        {
            Let the European-involvement of the Actor be eur-inv.
            If the European-involvement of the Actor is not
            (the Previous-European-involvement of the Actor)
            Then Log Log-file "European-involvement of" Actor "is now"
            eur-inv".
        }
    }
}

```

| <u>threat</u> | <u>effect</u> | <u>preference</u> | <u>eur-inv</u> |
|-------------------|---------------|-------------------|----------------|
| Grave | -- | -- | Normal |
| Indirectly-mortal | Low | -- | Disengaged |
| Indirectly-mortal | Medium | -- | Disengaged |
| Indirectly-mortal | High | -- | On-call |
| Mortal | Low | -- | Disengaged |
| Mortal | Medium | -- | Disengaged |

```

        Mortal           High    --           Combatant.
    }
Else If the Region of the Actor is not Europe
    and the Actor is not Turkey
    and the Actor is not Canada
Then
{
    Let the European-involvement of the Actor be Normal.
    If the Previous-European-involvement of the Actor is not Normal
    Then Log Log-file " Normal European involvement."
}
}

End.

Define Assess-promises:

[ Some countries may modify their behavior if their opponent has offered
  them some degree of safety in a conflict.  This function allows Actors
  to asses any such "promises."
]

If    the Orientation of the Actor is Blue
    or the Orientation of the Actor is White
Then
{
    If
    (
        the USSR-preference-for-side of the Actor is not Unspecified
        or
        the USSR-preference-for-cooperation of the Actor is Uncooperative
        or
        the USSR-preference-for-SWAsian-involvement of the Actor
        is Disengaged
        or
        the USSR-preference-for-European-involvement of the Actor
        is Disengaged
    )
    Then
    {
        If the Temperament of the Actor is Moderate
        and the Effectiveness of the Actor is Low
        and the Conflict-location-status of the Actor is None
        Then
        {
            Let the Side of the Actor be White.
            Let the Cooperation of the Actor be Normal.
            Let the Preparedness of the Actor be Normal.
            Let SWAsian-involvement of the Actor be Normal.
            Let the European-involvement of the Actor be Normal.
            Log Log-file Actor "has been promised safety by USSR."
        }
    }
}

```

```

Else If the Temperament of the Actor is Reliable
    and the Effectiveness of the Actor is Low
    and the Conflict-location-status of the Actor is Nuclear
Then
{
    Let the Side of the Actor be White.
    Let the Cooperation of the Actor be Normal.
    Let the Preparedness of the Actor be Normal.
    Let SWAsian-involvement of the Actor be Normal.
    Let the European-involvement of the Actor be Normal.
    Log Log-file Actor "has been promised safety by USSR.".
}
Else If the Temperament of the Actor is Reluctant
    or the Temperament of the Actor is Soft
Then
{
    If the Conflict-location-status of the Actor is Nuclear
    or the Effectiveness of the Actor is less than High
    Then
    {
        Let the Side of the Actor be White.
        Let the Cooperation of the Actor be Normal.
        Let the Preparedness of the Actor be Normal.
        Let SWAsian-involvement of the Actor be Normal.
        Let the European-involvement of the Actor be Normal.
        Log Log-file Actor "has been promised safety by USSR.".
    }
}
}
}

```

End.

Define Check-for-conflict:

[This function makes a country a Combatant if it has been invaded.]

```

If the Conflict-location-status of the Actor is at least Conv
and
(
    the Ally of the Actor is not the USSR and
    the Red-presence of the Actor is not None
or
    the Ally of the Actor is not the US and the
    the Blue-presence of the Actor is not None
)
Then
{
    If the Ally of the Actor is not Unspecified
    Then
    {
        Let the Side of the Actor be the Side of the ally.
    }
}

```

Let the Cooperation of the Actor be Cobelligerent.

If the Region of the Actor is Europe
and the European-involvement of the Actor is less than
Combatant

Then

{
 Let the European-involvement of the Actor be Combatant.
 If the Previous-European-involvement of the Actor
 is less than On-call
 Then Log Log-file
 "European combatant as location of conflict".
}

Else If the Region of the Actor is SWAsia
and SWAsian-involvement of the Actor is less than Combatant

Then

{
 Let SWAsian-involvement of the Actor be Combatant.
 If the Previous-SWAsian-involvement of the Actor
 is less than On-call
 Then Log Log-file "SWAsian combatant as location of conflict".
}

}
Else
{

Let the Side of the Actor be White.
Let the Cooperation of the Actor be Normal.

If the Region of the Actor is Europe
and the European-involvement of the Actor is less than
Combatant

Then

{
 Let the European-involvement of the Actor be Combatant.
 If the Previous-European-involvement of the Actor
 is less than On-call
 Then Log Log-file
 "European combatant as location of conflict".
}

Else If the Region of the Actor is SWAsia
and SWAsian-involvement of the Actor is less than Combatant

Then

{
 Let SWAsian-involvement of the Actor be Combatant.
 If the SWAsian-involvement of the Actor
 is less than On-call
 Then Log Log-file "SWAsian combatant as location of conflict".
}

}
}

End.

Define Check-for-call:

```
[ Check-for-call is used to change the Involvement of an Actor from On-call  
to Combatant when its ally has gone to war.  
]
```

For every Actor:

```
{  
    If the European-involvement of the (Ally of the Actor) is at least  
    Combatant  
    and the European-involvement of the Actor is On-call  
    Then Let the European-involvement of the Actor be Combatant.  
  
    If SWAsian-involvement of the (Ally of the Actor) is at least  
    Combatant  
    and SWAsian-involvement of the Actor is On-call  
    Then Let SWAsian-involvement of the Actor be Combatant.  
}
```

End.

Define Determine-assertive-response:

```
[ Determine-assertive-response is used to modify the actions of Actors which  
are defined as being Assertive.  
]
```

If the Assertive-status of the Actor is Yes

Then

```
{  
    If the Conflict-location-status of the Actor is Nuclear  
    Then  
    {  
        Let the Side of the Actor be the Side of the ally.  
        Let the Cooperation of the Actor be Nuc-releasor.  
        If the Nuclear-capability of the Actor is Yes  
        Then  
        {  
            If the Region of the Actor is SWAsia  
            Then  
            {  
                Let SWAsian-involvement of the Actor be  
                Nuc-combatant.  
            }  
            Else If the Region of the Actor is Europe  
            or the Actor is Canada  
            or the Actor is Turkey  
            Then  
            {  
                Let the European-involvement of the Actor be  
                Nuc-combatant.  
            }  
        }  
    }  
}
```

```

    If the Previous-European-involvement of the Actor
      is not Nuc-combatant
    Then Log Log-file "Nuclear-combatant assertive response to"
      " mortal threat.".
  }
Else
{
  If the Region of the Actor is SWAsia
  Then
  {
    Let SWAsian-involvement of the Actor be
      Combatant.
  }
  Else If the Region of the Actor is Europe
    or           the Actor is Canada
    or           the Actor is Turkey
  Then
  {
    Let the European-involvement of the Actor be
      Combatant.
    If the Previous-European-involvement of the Actor
      is not Combatant
    Then Log Log-file "Combatant assertive response to"
      " mortal threat.".
  }
}

}

If the Conflict-location-status of the Actor is Conv
and
(
  (
    the Ally of the Actor is not the USSR
    and
    the Red-presence of the Actor is not None
  )
  or
  (
    the Ally of the Actor is not the US
    and
    the Blue-presence of the Actor is not None
  )
)
Then
{
  Let the Side of the Actor be the Side of the ally.
  Let the Cooperation of the Actor be Nuc-releasor.
  If the Previous-cooperation of the Actor is not Nuc-releasor
  Then Log Log-file
    "Nuclear-releasor assertive response to invasion.".
}
```

```
If the Nuclear-capability of the Actor is Yes
Then
{
    If the Region of the Actor is SWAsia
    Then
    {
        Let SWAsian-involvement of the Actor be
        Nuc-combatant.
    }
    Else If the Region of the Actor is Europe
    or
        the Actor is Canada
    or
        the Actor is Turkey
    Then
    {
        Let the European-involvement of the Actor be
        Nuc-combatant.
    }
    Log Log-file "Nuclear-combatant assertive response to"
    " mortal threat.".
}
Else
{
    If the Region of the Actor is SWAsia
    Then
    {
        Let SWAsian-involvement of the Actor be
        Combatant.
    }
    Else If the Region of the Actor is Europe
    or
        the Actor is Canada
    or
        the Actor is Turkey
    Then
    {
        Let the European-involvement of the Actor be
        Combatant.
    }
    Log Log-file "Combatant assertive response to mortal threat.".
}
}
}

End.

Define Follow-leader:

[ This function insures that an actor will never exceed the Cooperation or
  Involvement of its defined policy Leader (if any).
]

Declare leader by example: Let the leader be Type-country.

Let the Leader of the Actor be the leader.
```

```
If the Cooperation of the Actor is greater than the
  Cooperation of the leader
Then
{
  Let the Cooperation of the Actor be the Cooperation of the leader.
  Log Log-file "Bringing cooperation into line with the"
    " policy of the leader.".
}
```

```
If the European-involvement of the Actor is greater than the
  European-involvement of the leader
Then
{
  Let the European-involvement of the Actor be the
    European-involvement of the leader.
  Log Log-file "Bringing European-involvement into line with the"
    " policy of the leader.".
}
```

```
If SWAsian-involvement of the Actor is greater than the
  SWAsian-involvement of the leader
Then
{
  Let the SWAsian-involvement of the Actor be the
    SWAsian-involvement of the leader.
  Log Log-file "Bringing SWAsian-involvement into line with the"
    " policy of the leader.".
}
```

End.

Define Queue:

```
[ This function assigns any requests which have not been agreed to to a
  queue, from which they will be extracted at the next Green Agent move,
  unless they have in the meantime been superseded by new superpower
  preferences.
]
```

```
If the Preference-for-side of the ally and Actor is not Unspecified
Then
{
  If the Side of the Actor is not the Preference-for-side of
    the ally and the Actor
  Then
  {
    Let the Pending-preference-for-side of the ally and the Actor be
      the Preference-for-side of the ally and the Actor.
  }
}
```

```
If the Preference-for-cooperation of the ally and Actor is not Unspecified
```



```
Then
{
  If the Cooperation of the Actor is not the Preference-for-cooperation
    of the ally and the Actor
  Then
  {
    Let the Pending-preference-for-cooperation of the ally and
      the Actor be the Preference-for-cooperation of the ally and
      the Actor.
  }
}
```

If the Preference-for-SWAsian-involvement of the ally and Actor is not
Unspecified

```
Then
{
  If SWAsian-involvement of the Actor is not the
    Preference-for-SWAsian-involvement of the ally and the Actor
  Then
  {
    Let the Pending-preference-for-SWAsian-involvement of the ally
      and the Actor be the Preference-for-SWAsian-involvement
      of the ally and the Actor.
  }
}
```

If the Preference-for-European-involvement of the ally and Actor is not
Unspecified

```
Then
{
  If the European-involvement of the Actor is not the
    Preference-for-European-involvement of the ally and the Actor
  Then
  {
    Let the Pending-preference-for-European-involvement of the ally
      and the Actor be the Preference-for-European-involvement of
      the ally and the Actor.
  }
}
```

End.

Define Link:

```
[ Link establishes the connection between an Actor's Involvement and its
  Preparedness.
]
```

```
If the Region of the Actor is Europe
  or          the Actor is Turkey
  or          the Actor is Canada
Then
```

```
{
  If      the European-involvement of the Actor is Normal
  Then Let the Preparedness of the Actor be Normal.
  Else If the European-involvement of the Actor is Low-alert
  Then Let the Preparedness of the Actor be Mobilized.
  Else If the European-involvement of the Actor is Full-alert
        or the European-involvement of the Actor is On-call
  Then Let the Preparedness of the Actor be Call-Up.
  Else Let the Preparedness of the Actor be Indus-Mobilization.
}
```

```
Else If the Region of the Actor is SWAsia
```

```
Then
```

```
{
  If      SWAsian-involvement of the Actor is Normal
  Then Let the Preparedness of the Actor be Normal.
  Else If SWAsian-involvement of the Actor is Low-alert
  Then Let the Preparedness of the Actor be Mobilized.
  Else If SWAsian-involvement of the Actor is Full-alert
        or SWAsian-involvement of the Actor is On-call
  Then Let the Preparedness of the Actor be Call-Up.
  Else Let the Preparedness of the Actor be Indus-Mobilization.
}
```

```
If the Cooperation of the Actor is greater than Normal
```

```
and the Temperament of the Actor is not Captive
```

```
and the Temperament of the Actor is not Satellite
```

```
Then Let the Side of the Actor be the Side of the (Ally of the Actor).
```

```
End.
```

```
Define Determine-alliance-involvement:
```

```
For Country NATO:
```

```
{
  If the European-involvement of the Country is Low-alert
  Then Let the NATO-involvement of the Country be Simple-alert.

  Else If the European-involvement of the Country is Sustain-alert
  Then Let the NATO-involvement of the Country be Reinforced-alert.

  Else If the European-involvement of the Country is Full-alert
  Then Let the NATO-involvement of the Country be General-alert.

  Else If the European-involvement of the Country is On-call
  Then Let the NATO-involvement of the Country be On-call.

  Else If the European-involvement of the Country is Combatant
  Then Let the NATO-involvement of the Country be Combatant.

  Else If the European-involvement of the Country is Nuc-combatant
  Then Let the NATO-involvement of the Country be Nuc-combatant.
}
```

Else If the European-involvement of the Country is Disengaged
Then Let the NATO-involvement of the Country be Disengaged.

Else If the European-involvement of the Country is Normal
Then Let the NATO-involvement of the Country be Normal.

}

For Country WP:

{

If the European-involvement of the Country is Low-alert
or the European-involvement of the Country is Sustain-alert
Then Let the WP-involvement of the Country be
Increased-readiness.

Else If the European-involvement of the Country is Full-alert
Then Let the WP-involvement of the Country be Maximum-readiness.

Else If the European-involvement of the Country is On-call
Then Let the WP-involvement of the Country be On-call.

Else If the European-involvement of the Country is Combatant
Then Let the WP-involvement of the Country be Combatant.

Else If the European-involvement of the Country is Nuc-combatant
Then Let the WP-involvement of the Country be Nuc-combatant.

Else If the European-involvement of the Country is Disengaged
Then Let the WP-involvement of the Country be Disengaged.

Else If the European-involvement of the Country is Normal
Then Let the WP-involvement of the Country be Normal.

}

End.

Define Send-messages-and orders:

{ This function actually sends out all force orders to CAMPAIGN and any
messages to either superpower.

}

If Assertive-status of the FRG is Yes
and the Conflict-location-status of the FRG is not None
and the Effectiveness of the FRG is not High
and the Actor is the FRG

Then

{

Let Message-to-superpower of US and FRG be
Demand-nuclear-defense-of-country.

Log Log-file "FRG demands Blue nuclear defense."

}

If the European-involvement of the Actor is at least Low-alert
or the SWAsian-involvement of the Actor is at least Low-alert
Then

{
 If the Alert-flag of the Actor is not Full
 Then
 {

 Table Alert-order

| <u>unit</u> | <u>owner</u> | <u>in-region</u> | <u>%-ready</u> |
|-------------|--------------|------------------|----------------|
| all | Actor | all | 100 |

 Log Log-file " Actor alerting active forces."
 Let the Alert-flag of the Actor be Full.

 }
}

If the European-involvement of the Actor is at least Full-alert
or the SWAsian-involvement of the Actor is at least Full-alert
Then

{
 If the Mobilization-flag of the Actor is not Full
 Then
 {

 Table Mobilize-order

| <u>unit</u> | <u>owner</u> | <u>in-region</u> | <u>%-ready</u> |
|-------------|--------------|------------------|----------------|
| all | Actor | all | 100 |

 Log Log-file " Actor mobilizing reserves."
 Let the Mobilization-flag of the Actor be Full.

 }
}

If the Ally of the Actor is the US
and the Ally-flag of the Actor is not Blue
Then

{
 Table Ally-order
 govt side
 Actor Blue .

 Let the Ally-flag of the Actor be Blue.

 }

Else If the Ally of the Actor is the USSR
and the Ally-flag of the Actor is not Red
Then

{
 Table Ally-order

| <u>govt</u> | <u>side</u> |
|-------------|-------------|
| Actor | Red . |

Let the Ally-flag of the Actor be Red.

}

Else If the Ally-flag of the Actor is not White
and the Ally of the Actor is not the US
and the Ally of the Actor is not the USSR

Then

{

Table Ally-order

| <u>govt</u> | <u>side</u> |
|-------------|-------------|
| Actor | White. |

Let the Ally-flag of the Actor be White.

}

If Side of the Actor is not White

Then

{

If the Cooperation of the Actor is Uncooperative
or the Cooperation of the Actor is Normal
and the Previous-cooperation of the Actor is not
Uncooperative
and the Previous-cooperation of the Actor is not
Normal
and the Cooperation-flag of the Actor is not Uncooperative
and the Cooperation-flag of the Actor is not Normal

Then

{

Table Cooperate-order

| <u>govt</u> | <u>permit-deny</u> | <u>right</u> |
|-------------|--------------------|--------------|
| Actor | Deny | Overfly |
| Actor | Deny | Transit |
| Actor | Deny | Basing |
| Actor | Deny | Nuclear. |

Let Cooperation-flag of the Actor be Uncooperative.

}

E. If the Previous-cooperation of the Actor is not
(the Cooperation of the Actor)
and the Cooperation-flag of the Actor is not Cobelligerent
and

(

the Cooperation of the Actor is Transit-base
or the Cooperation of the Actor is Reinforcement
or the Cooperation of the Actor is Cobelligerent

)

Then

```
{
  Table Cooperate-order
    govt    permit-deny    right
    =====
    Actor   Permit         Overfly
    Actor   Permit         Transit
    Actor   Permit         Basing
    Actor   Deny           Nuclear.

  Let the Cooperation-flag of the Actor be Cobelligerent.
}
Else If the Previous-cooperation of the Actor is not
      (the Cooperation of the Actor)
      and the Cooperation of the Actor is Nuc-releasor
      and the Cooperation-flag of the Actor is not
        Nuc-releasor
Then
{
  Table Cooperate-order
    govt    permit-deny    right
    =====
    Actor   Permit         Overfly
    Actor   Permit         Transit
    Actor   Permit         Basing
    Actor   Permit         Nuclear.
}

If the European-involvement of the Actor is at least On-call
or the SWAsian-involvement of the Actor is at least On-call
Then
{
  If the Ally of the Actor is the US
  and the Control-flag of Actor is not Blue
  Then
  {
    Table Control-order
      govt    side
      =====
      Actor   Blue .

    Let the Control-flag of the Actor be Blue.
  }

  If the Ally of the Actor is the USSR
  and the Control-flag of the Actor is not Red
  Then
  {
    Table Control-order
      govt    side
      =====
      Actor   Red .
  }
}
```

```
        Let the Control-flag of the Actor be Red.
      }
    }

  }

End.

Define Check-for-superpower-requests:

[The name of this function is self-explanatory. ]

Declare count by example:      Let count be 1.
Declare count-log by example:  Let count-log be Output.

Let count be 0.

If USSR-preference-for-side of actor
  is not Unspecified
Then
{
  If wakeup-flag is Yes
  Then Exit reporting Yes.
  Else If wakeup-flag is No
  Then
  {
    Let count be count + 1.
    Log Log-file actor "has received a preference of"
      (USSR-preference-for-side of actor) "from USSR.".
  }
}

If USSR-preference-for-cooperation of actor
  is not Unspecified
Then
{
  If wakeup-flag is Yes
  Then Exit reporting Yes.
  Else If wakeup-flag is No
  Then
  {
    Let count be count + 1.
    Log Log-file actor "has received a preference of"
      (USSR-preference-for-cooperation of actor) "from USSR.".
  }
}

If USSR-preference-for-SWAsian-involvement of actor
  is not Unspecified
Then
{
  If wakeup-flag is Yes
```

```
Then Exit reporting Yes.
Else If wakeup-flag is No
Then
{
    Let count be count + 1.
    Log Log-file actor "has received a preference of"
        (USSR-preference-for-SWAsian-involvement of actor)
        "from USSR.".
}
}

If USSR-preference-for-European-involvement of actor
is not Unspecified
Then
{
    If wakeup-flag is Yes
    Then Exit reporting Yes.
    Else If wakeup-flag is No
    Then
    {
        Let count be count + 1.
        Log Log-file actor "has received a preference of"
            (USSR-preference-for-European-involvement of actor)
            "from USSR.".
    }
}

If US-preference-for-side of actor
is not Unspecified
Then
{
    If wakeup-flag is Yes
    Then Exit reporting Yes.
    Else If wakeup-flag is No
    Then
    {
        Let count be count + 1.
        Log Log-file actor "has received a preference of"
            (US-preference-for-side of actor) "from US.".
    }
}

If US-preference-for-cooperation of actor
is not Unspecified
Then
{
    If wakeup-flag is Yes
    Then Exit reporting Yes.
    Else If wakeup-flag is No
    Then
    {
        Let count be count + 1.
```



```
        Log Log-file actor "has received a preference of"
          (US-preference-for-cooperation of actor) "from US.".
      }
}

If US-preference-for-SWAsian-involvement of actor
  is not Unspecified
Then
{
  If wakeup-flag is Yes
  Then Exit reporting Yes.
  Else If wakeup-flag is No
  Then
  {
    Let count be count + 1.
    Log Log-file actor "has received a preference of"
      (US-preference-for-SWAsian-involvement of actor)
      "from US.".
  }
}

If US-preference-for-European-involvement of actor
  is not Unspecified
Then
{
  If wakeup-flag is Yes
  Then Exit reporting Yes.
  Else If wakeup-flag is No
  Then
  {
    Let count be count + 1.
    Log Log-file actor "has received a preference of"
      (US-preference-for-European-involvement of actor)
      "from US.".
  }
}

If count > 0
Then
{
  Let count be 0.
  Exit reporting Yes.
}
Else Exit reporting No.

End.

Define Check-for-threats-to-allies:

[ The name of this function is self-explanatory. ]

  If alliance is None
```

or alliance is Unspecified
Then Exit reporting No.

For Country:

```
{
  If Membership of Country is alliance
  Then
  {
    If the Conflict-location-status of Country is
      greater than None
    or the US-border-mobilization-status of Country is Yes
    or the USSR-border-mobilization-status of Country is Yes
    or the US-intent-to-attack of Country is Yes
    or the USSR-intent-to-attack of Country is Yes
    Then Exit reporting Yes.
  }
}
```

Exit reporting No.

End.

Define Check-for-pending-preferences:

Declare superpower by example: Let superpower be Type-country.

For superpower (US or USSR):

```
{
  If the Pending-preference-for-side
    of the superpower and the actor is not Unspecified
  or the Pending-preference-for-cooperation
    of the superpower and the actor is not Unspecified
  or the Pending-preference-for-SWAsian-involvement
    of the superpower and the actor is not Unspecified
  or the Pending-preference-for-European-involvement
    of the superpower and the actor is not Unspecified
  Then Exit reporting Yes.
  Else Exit reporting No.
}
```

End.

APPENDIX B
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